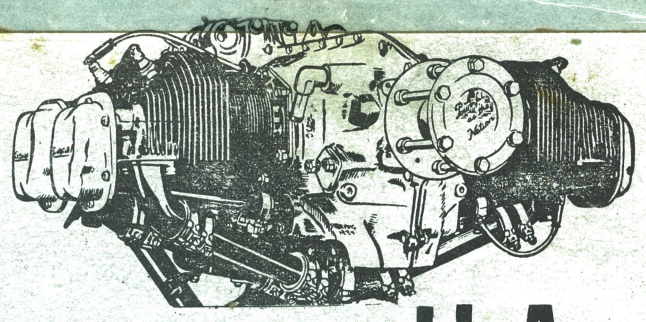
VariEze

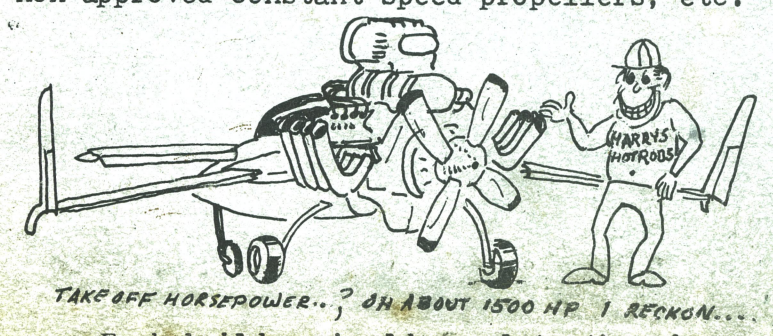


MANUFACTURING MANUAL SECTION II A

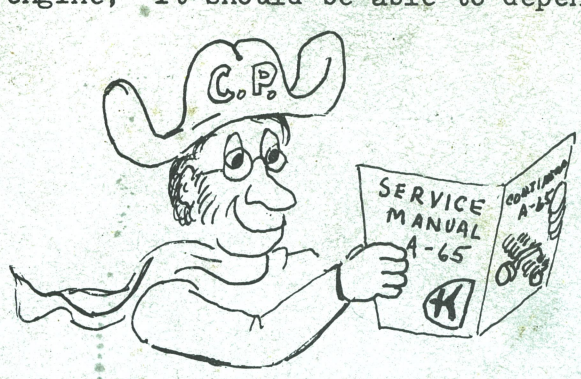
INTRODUCTION

Section IIA of the VariEze manufacturing manual provides engineering documentation for the installation of Continental aircraft engines. The installation methods and configuration shown in this section have been carefully developed to provide the builder with a simple and reliable engine installation. Builder-initiated modifications to this installation are not recommended. The individual who does initiate his own installation or systems modification must consider himself to be in the developmental engineering business and be prepared to assume the risks and precautions that go with it.

In the same respect, RAF does not encourage the use of engine or installation components which would not be considered fit for service in a certificated aircraft. Specifically, engine service standards as defined by Continental Motor's service manuals and bulletins should be complied with. Any engine or component that isn't suitable for use in a Cub, Cessna 150, etc., is probably unfit for service in your VariEze. This philosophy applies to the use of non-approved accessories such as carburetors, turbo chargers, non-approved constant-speed propellers, etc.



Each builder should complete the education which he has begun in building his airplane by becoming knowledgeable about the engine he buys and flies and maintains. You can save yourself some grief, not to mention big bucks, by learning something about your engine before you buy it. Very complete and informative maintenance and overhaul manuals are available at low cost (under $10) from VariEze distributors and many other aviation supply houses. Buy a copy of the manual covering your engine and study it. You depend on your engine; it should be able to depend on you.



The small Continental engines A-65, A-75, A-80, C-75, C-85, C-90, and 0-200 (65 to 100 hp) comprise the largest number of available powerplants suitable for use in the VariEze. Unfortunately these engines are the most common selection for other types of amatuer-built aircraft and they are in regular demand for use in antique restoration projects. The popularity of these engines keeps the market for them quite lively and may make finding the engine of your choice a bit challenging. The popularity of the small Continentals has had the detrimental effects of encouraging a few black-hearted thieves to sell uninformed and trusting individuals engines which have had only "spray can" overhauls as OSMOH engines. Let the buyer beware. If you don't wish to become knowledgeable enough to avoid these shysters, yourself, hire a trusted A & P or AI-rated mechanic to be knowledgeable for you, before you buy.

Configuration

The general configuration of the engine installation described here is conventional with few exceptions. The noteworthy exceptions are the use of updraft cooling, small diameter fixed-pitch wood propeller, and the recommended use of the 0-200-A model as a pusher. The VariEze utilizes updraft (from bottom to top) cooling for a variety of reasons: first, the accessories (mags, alternator, etc.) are on the cold air side prolonging their service life; second, the engine "hot spots" (exhaust ports, oil sump, etc.) are cooled first and most efficiently; third, the best cooling air pressure gradient available is from below the wing to the prop. All of these features combine for a simple and effective cooling system. A fixed-pitch wood propeller was selected first for fatigue-free service not possible with metal props, second, for minimum weight, and third for simplicity and low cost. The efficiency of a well designed modern, two-blade, wood prop is essentially equal to the best metal props at half to one-third the weight. The performance compromise in using fixed pitch instead of variable pitch/constant speed (adjustable) does not limit the airplane's utility at all. The weight and complexity penalty in using constant-speed/variable-pitch propellers is totally unthinkable for the VariEze. The vibration characteristics of a pusher prop might compromise the service life or even basic flight safety of an adjustable propeller. With the tip speeds used, multi-bladed props have no performance improvements to offer, only weight and cost penalties. It is the lower thrust of the high speed, fixed-pitch prop which makes the installation of the 0-200-A engine acceptable in this pusher aircraft (refer to owner's manual for data). In more conventional and slower pusher applications where thrust loadings are much higher (as in a Breezy or Volmer amphibian) the very rare 0-200-B would be required. The installation of an adjustable propeller (weight, cost and complexity aside) on the 100-hp VariEze would also require the -B model 0-200.

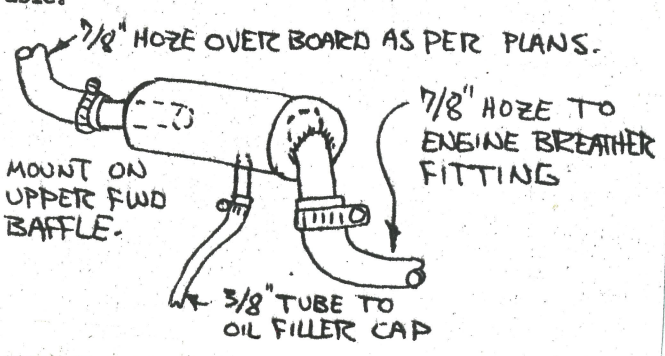
The Engine

As you become knowledgeable about the small Continental engines, you will soon discover that there are a whole basket-full of variations possible that fall in this category. There are variations within each model (A-65-8, A-65-8F, A65-12, A-65-14, A-65-8FJ, etc.,) that are far too numerous to completely describe here; that's what your service manual is for. The commonality in all of these models, dash numbers, etc., that makes it possible for RAF to cover their installations in one manual is this: they all may use the same engine mount; they are all dimensionally similar; the cooling characteristics are similar; the cowling fits them all; the exhaust system fits them all; and the details of wiring and accessories are nearly identical. The minor dimensional differences between the various models require no major modification of the system proven by service test in the prototype. For example, when you locate the holes for the exhaust system to exit your cowling, the 0-200 installation requires that the holes be further outboard than for the A-75. Bear these differences in mind while you install your engine, and if a baffle pattern is shown full size for the 0-200, make one from paper first to see if it will need modification to fit your C-85. Keep your eyes open for small differences and we'll alert you to anything major.

In every way possible the engine installation has been kept as simple and light as possible. Electric starters available on C-75, C-85, C-90, and 0-200 models are not recommended in this installation because they offer very little in added convenience or safety and give you another heavy (40 lbs) system to buy, and maintain. See section IV (owner's manual) for a complete operational description of the manual-starting technique. As you install your own engine, try to resist the temptation of gadgetry; keep it simple - keep it light.

VARIEZE CONTINENTAL ENGINE - installation in N4EZ has been flown about 53 hours since CP# 13. The installation continues to be trouble free. During the Oshkosh trip we found that it is rather susceptible to carb ice, similar to a Cessna 150. The carb iced up three times, each time carb heat was adequate to clear the ice. We found it advisable to cruise with heat on when in moist air conditions, cruising at 50% power.

If you are losing more than 1/8 qt oil per hour out the breather, install an oil separator as shown below. This can be homemade by welding ends and tubes into a 4-inch length of 2-inch dia aluminum tube. Several commercial separators are also available.



ENGINE AND ACCESSORY WEIGHTS

In spite of our best efforts to convince you to keep your airplanes simple, a few of you are die-hard gadgeteers and will insist on loading your engines up with starters, generators, alternators and all sorts of non essential equipment. One of you, at least, will push the engine installation weight to the absolute limit no matter what the consequences are. We want you to know in advance what the absolute weight limit of the installation (this includes everything not just the engine!) is, and why. The absolute maximum weight of the total installation, including engine, accessories, mount, prop extension, prop, mounting hardware, baffling, engine oil, header tank, and inlet flange is 240 pounds. This limit means that your engine, complete with accessories, can't weigh over 215 pounds. Exceeding the 215 lb. engine limit will jeopardize the structural design of the airframe. To help you all stay within bounds a tabulation of engine and accessory weights is provided. This data is taken directly from the FAA type certificate data sheets for these engines.

ENGINE MODEL	BASIC DRY WEIGHT (mags and carb only)	WITH GENERATOR OR ALTERNATOR	GENERATOR & SHIELDED IGNITION	GENERATOR & STARTER
A-65 A-75 A-80	170-173	none	173-176	none
C-75-8 C-85-8	177-178	none	180-181	none
C-75-12 C-85-12	180-182	190	193	209
C-90-8	184	none	187	none
C-90-12	188	198	201	217**
O-200-A	190	201	204	220**

** These configurations are unacceptably heavy

BILL OF MATERIALS

⊛ Change tygothane Part # 0505-107 To 0585-107

The following materials are available from
Aircraft Spruce & Specialty or Wicks Aircraft Supply
PO Box 424 — 1100 5th Street
Fullerton, Ca. 92632 — Highland, Il. 62249

Sheet Metal
- .063 2024-T3 alum, approx 6" x 12"
- .025 6061-T6 approx 12 sq ft

Hardware
- Bolts
  - AN3-5A (14)
  - AN3-6A (2)
  - AN3-7A (2)
  - AN3H-3A (3)
  - AN4-12A (4)
  - AN4-13A (2)
  - AN4-15A (2)
- Nuts
  - MS21042-3 (15)
  - MS21042-4 (12)
- Washers
  - AN960-06 (100)
  - AN970-3 (2)
- Grommets
  - AN931-6-10 (2)
- Rivets
  - Avex 1601-0410 (120) BAFFLES
  - Avex 1604-0412 (60) COWL
  - or
  - Cherry MSP 43 (120) BAFFLES
  - Cherry MSC 43 (60) COWL

Misc
- 2-1/2" dia worm clamp (4)
- MS20001-5 hinge (3 inches)
- 2-1/2" CAT-10 black hose (30")
- 2-1/2" SCAT-10 red hose (30")
- 1/16" aircraft 7 x 7 steel cable (9 ft)
- 3/16" OD polypenco nyloflo tubing (9 ft)
- 18-1-C Nicopress sleeve (5)
- AN111-4 spool (1)
- AN100-3 thimble (4)
- Century Spring Corp C-161 (8) 4 required
- Rubber-asbestos firewall fabric 1/16" thick (3 sq ft)
- TY-525M TY-RAP straps (20)
- TY-528M TY-RAP straps (8)
- Alco switch MTF-106N (2)
  - or
- Micro switch 8A1011 (2)
- RC10-14 solderless terminals (2)
- ~~12~~ 18 gauge non-shielded airframe elct. wire (30) ft) 30 ft.

NOTE: Items included with Brock prefab parts are not listed. Optional items (i.e. camlocs vs. AN507 screws for cowling) are not listed. Due to options, the engine instruments and wiring are not listed here (see page 4). The Aircraft Spruce catalog gives complete description of all instruments. Due to the wide variety of options, the distributors are not packaging a "kit" for section IIA. The listed items and non-listed items are available from Aircraft Spruce and Wicks. Determine your specific requirements before ordering.

The following prefab items are being made available from Ken Brock Manufacturing, 11852 Western Ave., Stanton, Ca. 90680. If you are on Brock's mailing list, he will be notifying you of the availability of these items.

FUEL SYSTEM INCLUDING (CP-18 Page 5) ⊛
- 4 ft tygothane ~~0505-165~~ 5/8 I.D.-7/8 O.D. (Breather hose)
- 30 ft tygothane 0585-107 3/8 ID-1/2 OD
- 3 ea 0715-020 polyurethane tee
- 2 ea 0700-158 polyurethane adapter
- 3 ea 0710-162 polyurethane elbow
- 1 ea crosslinkable polyurethane fuel header tank
- 1 ea fuel manifold with drain, valve, mounting hardware, and 3 fittings
- 2 ea VA6 filters
- 6 ea 1/2" worm clamps
- 1 ea AN822-6D fitting

Exhaust System Including
- 4 mild steel pipes/flange weldments
- 4 gaskets
- 8 brass nuts 5/16 x 24

Engine Mount
- 4130 weldment

Spacer Kit Including
- 1 ea 1/2 OD x 5/16 ID x 1/2 L alum
- 1 ea 1/4 OD x 3/16 ID x 1/4 L steel
- 1 ea 5/16 OD x 3/16 ID x 1/4 L steel

Throttle Quadrant Including
- Throttle, mixture and carb heat levers, machined quadrant, cables and housings

Carb Heat Valve Assembly
Carb Heat Muff Assembly

⊛ Install the Gascolator, fire resistant fuel lines and Valve as shown in news letter #18-

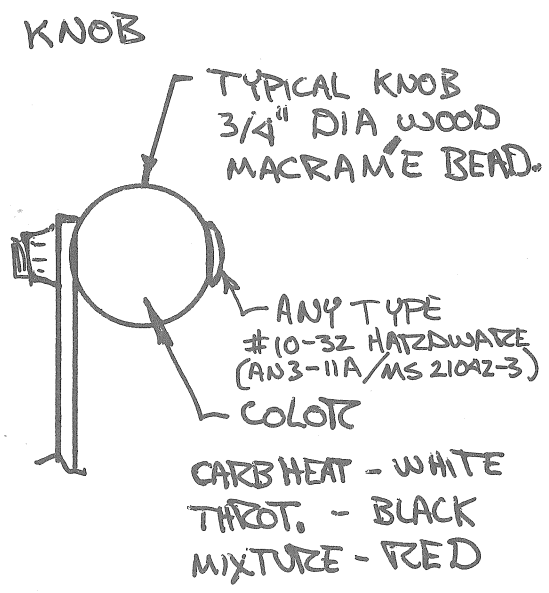
The fiberglass, cowling, complete with end ribs is being made available (after mid-November) from Fred Jiran, Bldg 6, Mojave Airport, Mojave, Ca. 93501.

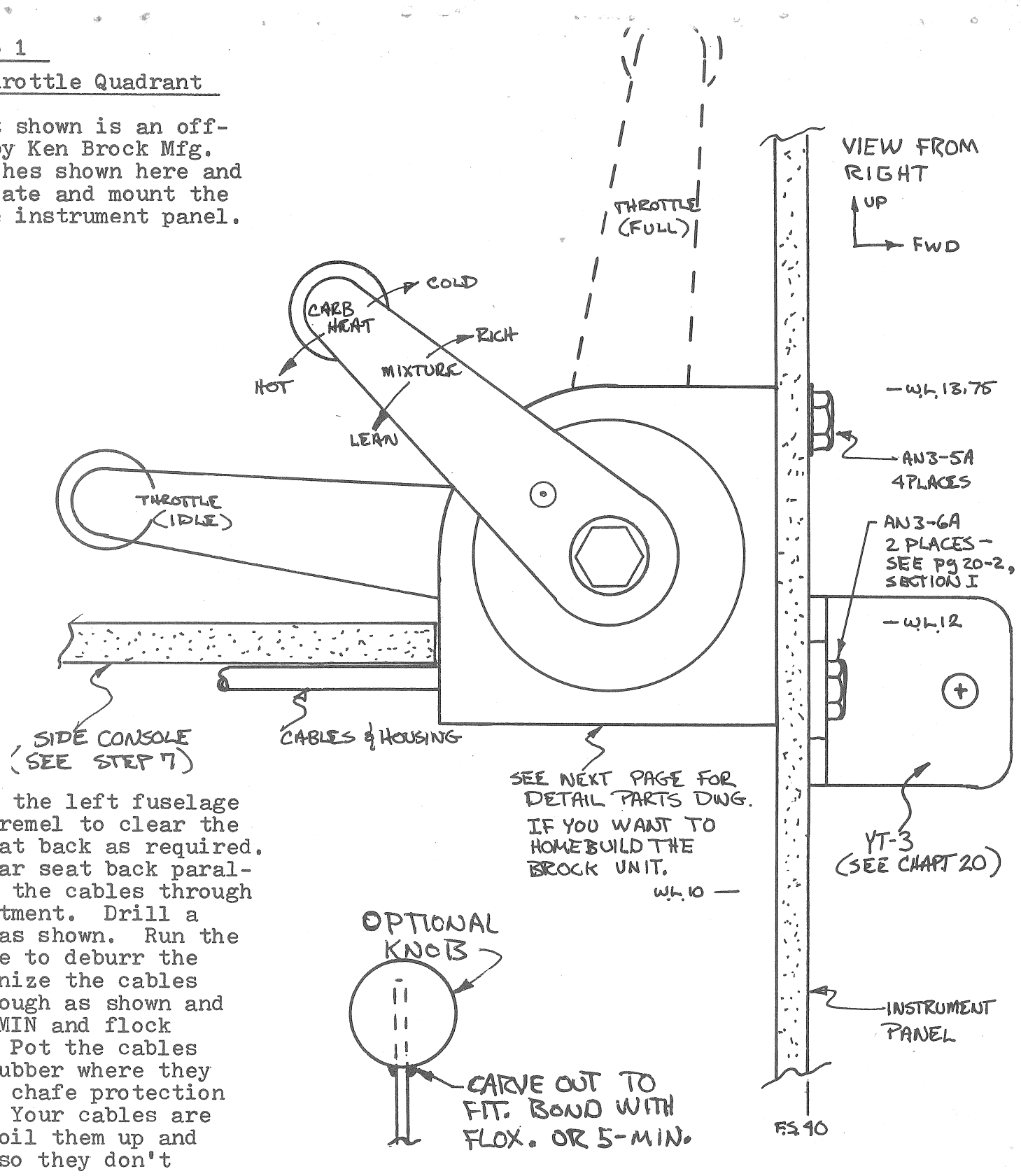
Step 1

Installing the Throttle Quadrant

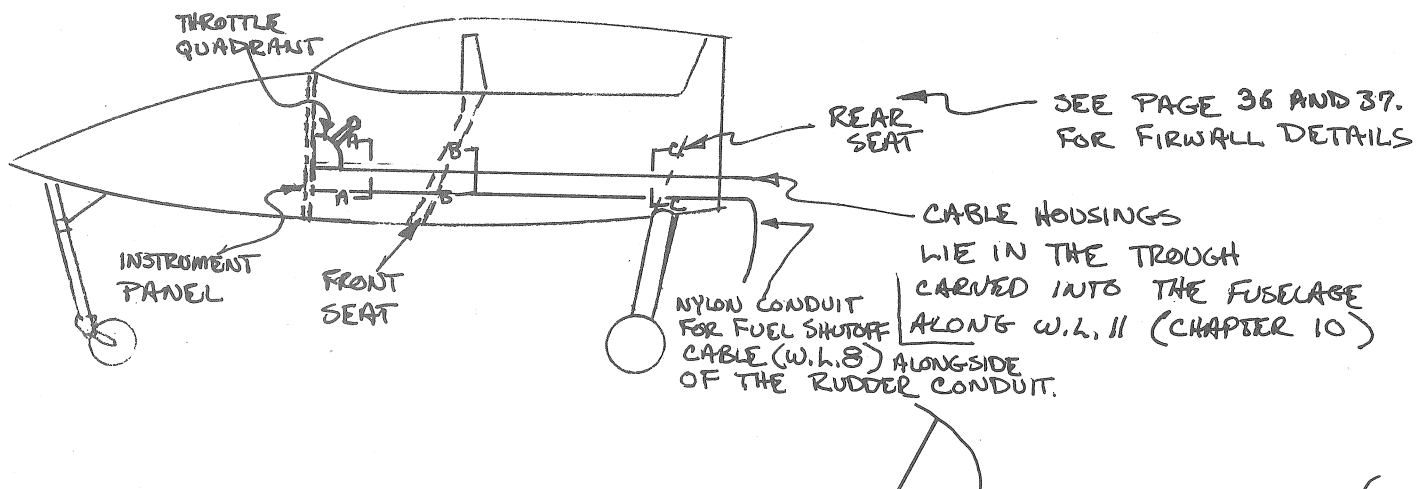
The throttle quadrant shown is an off-the-shelf unit developed by Ken Brock Mfg.

Referring to the sketches shown here and page A-1 of section I, locate and mount the throttle quadrant to the instrument panel.

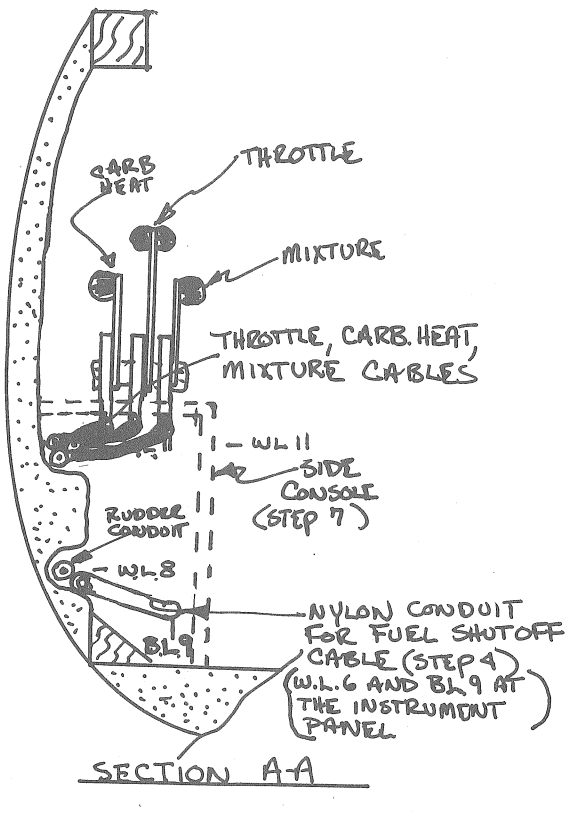




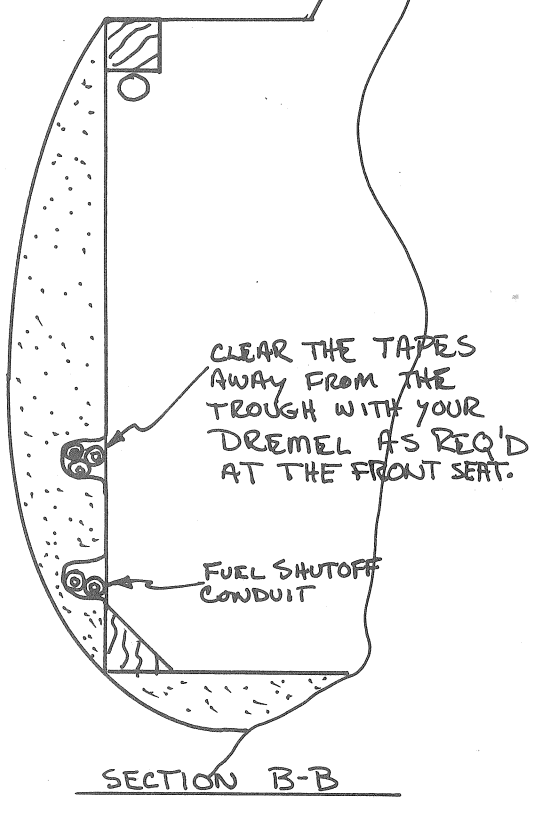
Route the cables aft along the left fuselage side as shown. Use your dremel to clear the trough around the front seat back as required. Bore a 1/2" hole in the rear seat back parallel to the trough and feed the cables through it into the baggage compartment. Drill a 1/2" hole in the firewall as shown. Run the cables through it. Be sure to deburr the stainless edgeswell. Organize the cables into the fuselage side through as shown and bond it in with ablob of 5MIN and flock every eight inches or so. Pot the cables generously with silicone rubber where they penetrate the firewall for chafe protection and to seal the firewall. Your cables are overly long still; just coil them up and tape them to the firewall so they don't get damaged.



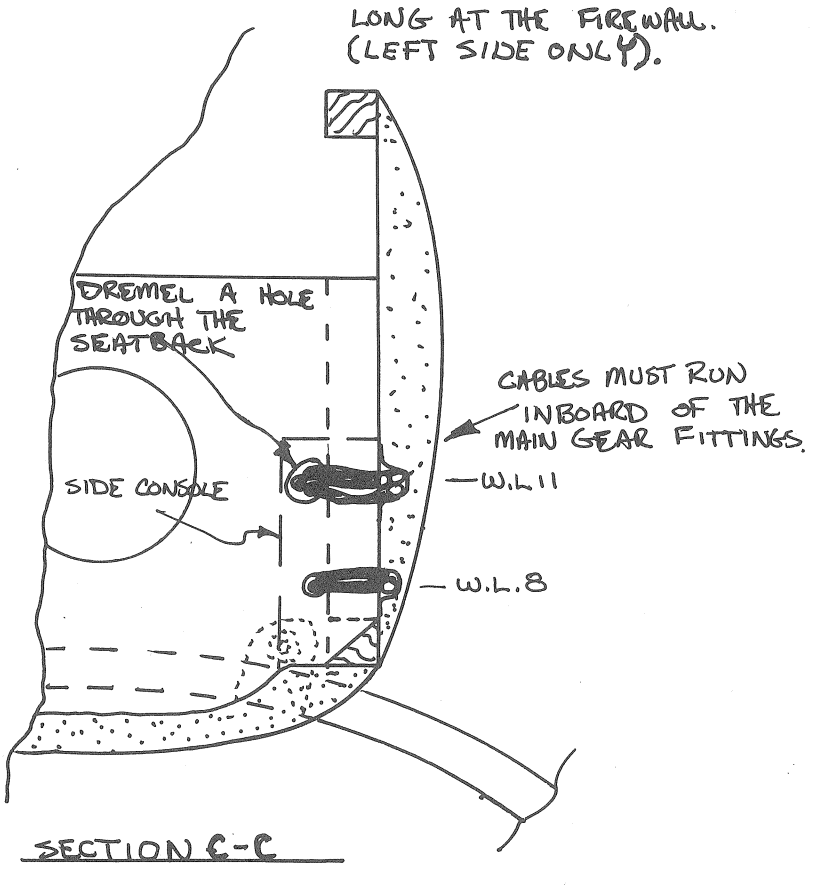
CUT A 100 INCH LONG PIECE OF NYLON CONDUIT AND LOCATE IT ALONG THE SAME TROUGH AS THE RUDDER CABLE CONDUIT. THIS WILL BE THE FUEL SHUTOFF CABLE CONDUIT. IT RUNS FROM F.S. 40 (INST. PANEL) TO THE FIREWALL. LEAVE IT LONG AT THE FIREWALL. (LEFT SIDE ONLY).



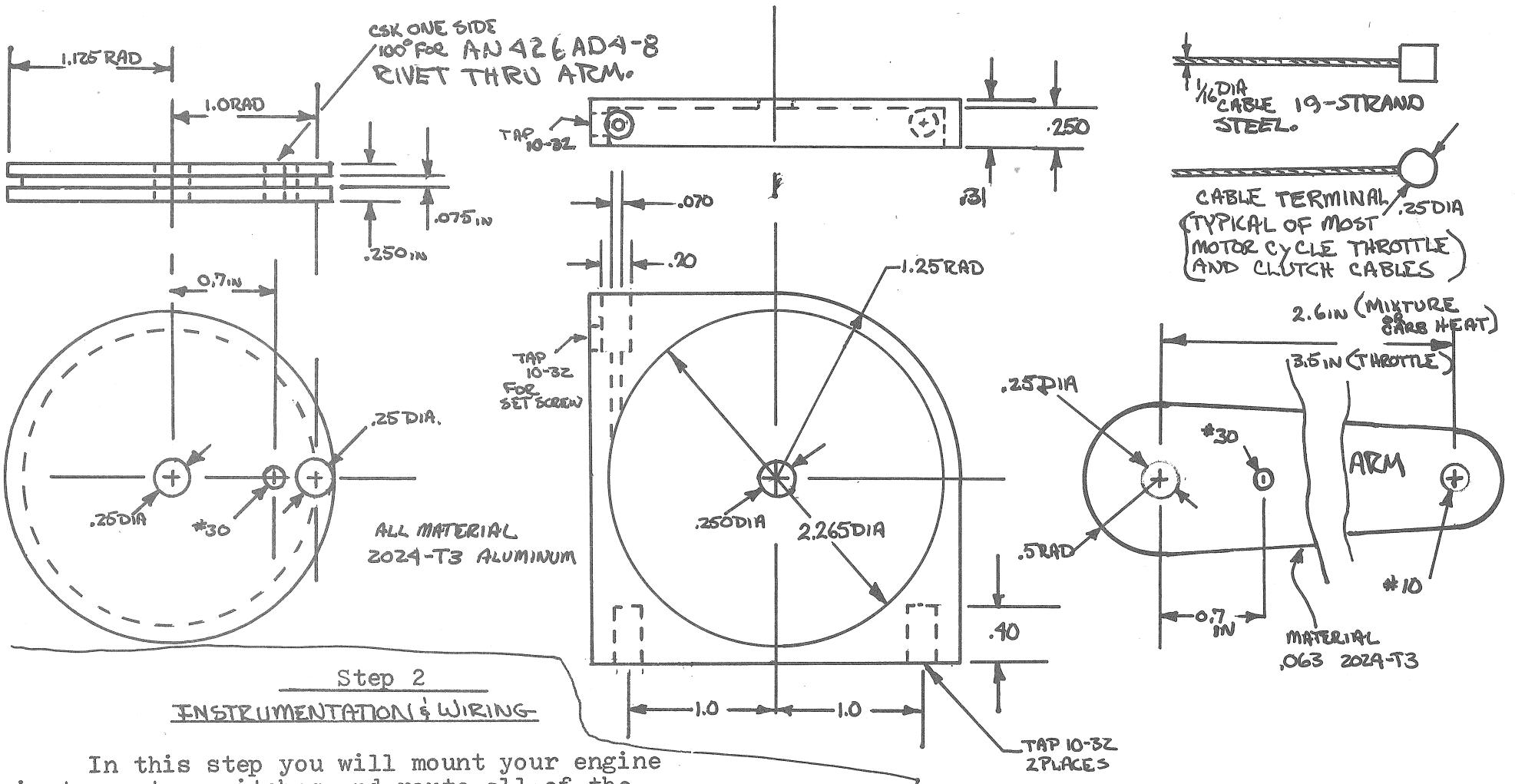
SECTION A-A



SECTION B-B



SECTION C-C



Step 2

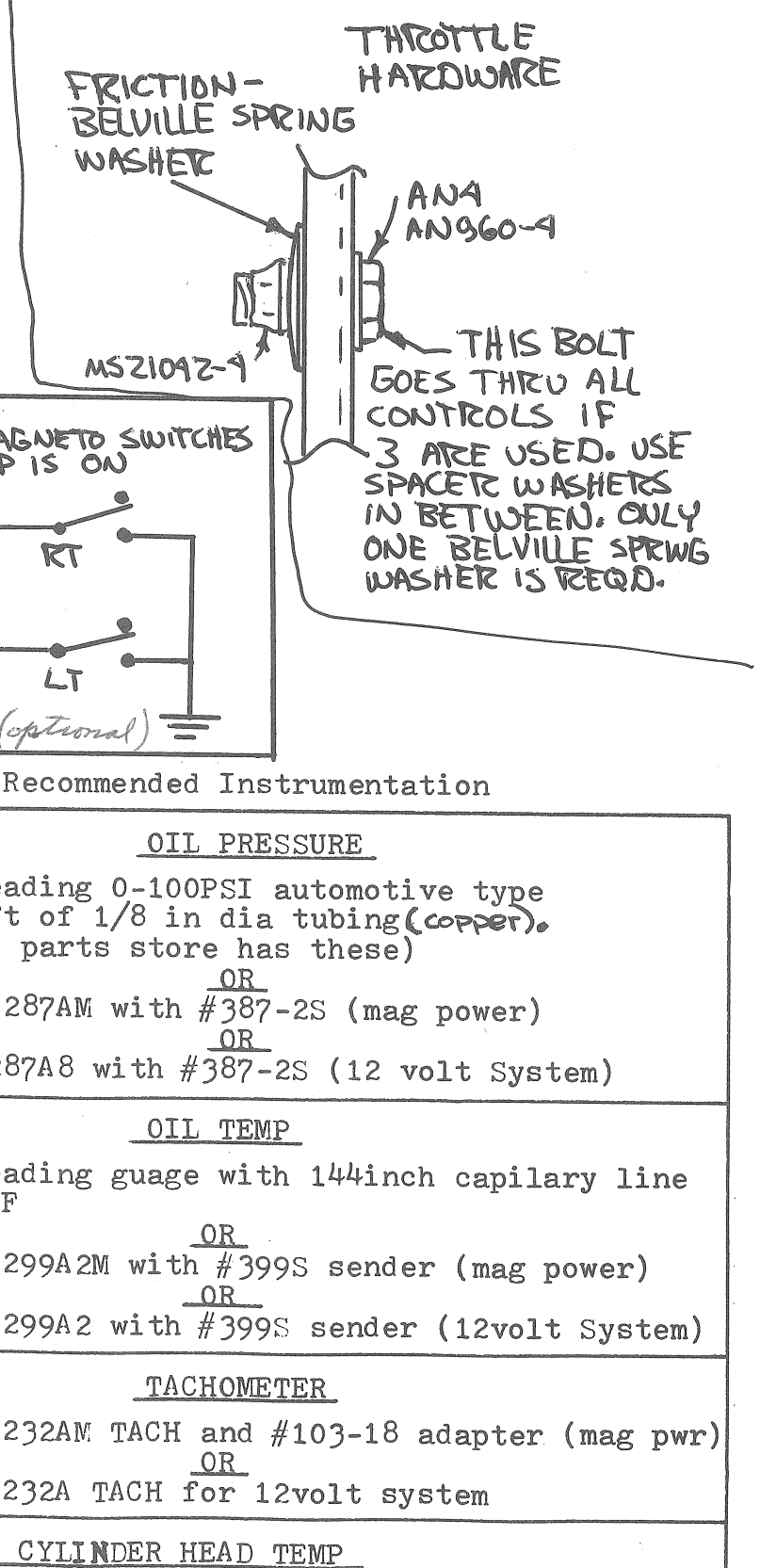
INSTRUMENTATION & WIRING

In this step you will mount your engine instruments, switches, and route all of the associated equipment to the firewall. Direct-reading instrumentation or magneto-powered instrumentation is recomended since the basic VariEze will not have an electrical system. Electrical instrumentation may be substituted (section III) by those builders installing electrical systems. All of the instrumentation called for in this step is available through a VariEze Distributor.

First, mount your instruments (Tachometer, Cylinder Head Temp, Exhaust Gas Temp, Oil Temp, Oil Pressure) on the instrument panel. Direct reading instruments must have lines at least 10 ft. long . Mechanical tachometers are not really practical due to the long cable required. A magneto-powered electric tach as shown is recommended. Mount your magneto switches in the areas shown on page A-1. (SECT I) Good miniature switches for the magneto are Micro 8A1011 or Alco MTF-106N. The standard key-type off-left-right-both switch is fine for those desiring a key-type switch.

With all of these mounted, take your dremel and clear the trough in the fuselage right side (W.L.12) through the front seat back and grind a 1/2"-dia hole through the rear seat back to allow the instrumentation into the baggage compartment like you did in step one. Drill a 1/2"-dia hole through the firewall at approximately B.L.6.5 right and W.L.12.0 (below and inboard of your lower-right engine mount extrusion). Be sure to deburr and smooth the stainless steel edges so they won't chafe your wiring. Push your instrumentation wiring, oil pressure tubing, and oil temperature lines through both seat bulkheads and the firewall. Locate the instrumentation bundle down in the groove in the fuselage side and be sure that it doesn't interfere with the rudder cable in the baggage compartment. Be very careful not to kink or pinch the oil temperature or oil pressure lines while routing them through the fuselage. At this point you may wish to route additional wiring for navigation lights, etc. Refer to section III for these requirements.

With all of the instrumentation and any additional wiring in place, mix a batch of 5MIN and flock, and bond the instrumentation/wiring to the fuselage with a blob every 8 inches or so. Pot the bundle amply with silicone rubber caulk where it passes through the firewall to serve as a chafe barrier and to seal the firewall. Coil the excess length of the bundle and tape it to the firewall so it doesn't get damaged. Attach the oil pressure tube to the instrument and solder the magneto wiring, ground wire, and other instrumentation wiring in place. Be sure to use good quality solder intended for electronics work.



Recommended Instrumentation

OIL PRESSURE

Direct reading 0-100PSI automotive type with 14 ft of 1/8 in dia tubing (copper). (any auto parts store has these)

OR

WESTACH #287AM with #387-2S (mag power)

OR

WESTACH #287A8 with #387-2S (12 volt System)

OIL TEMP

Direct reading guage with 144inch capilary line 100°- 250° F

OR

WESTACH #299A2M with #399S sender (mag power)

OR

WESTACH #299A2 with #399S sender (12volt System)

TACHOMETER

WESTACH #232AM TACH and #103-18 adapter (mag pwr)

OR

WESTACH #232A TACH for 12volt system

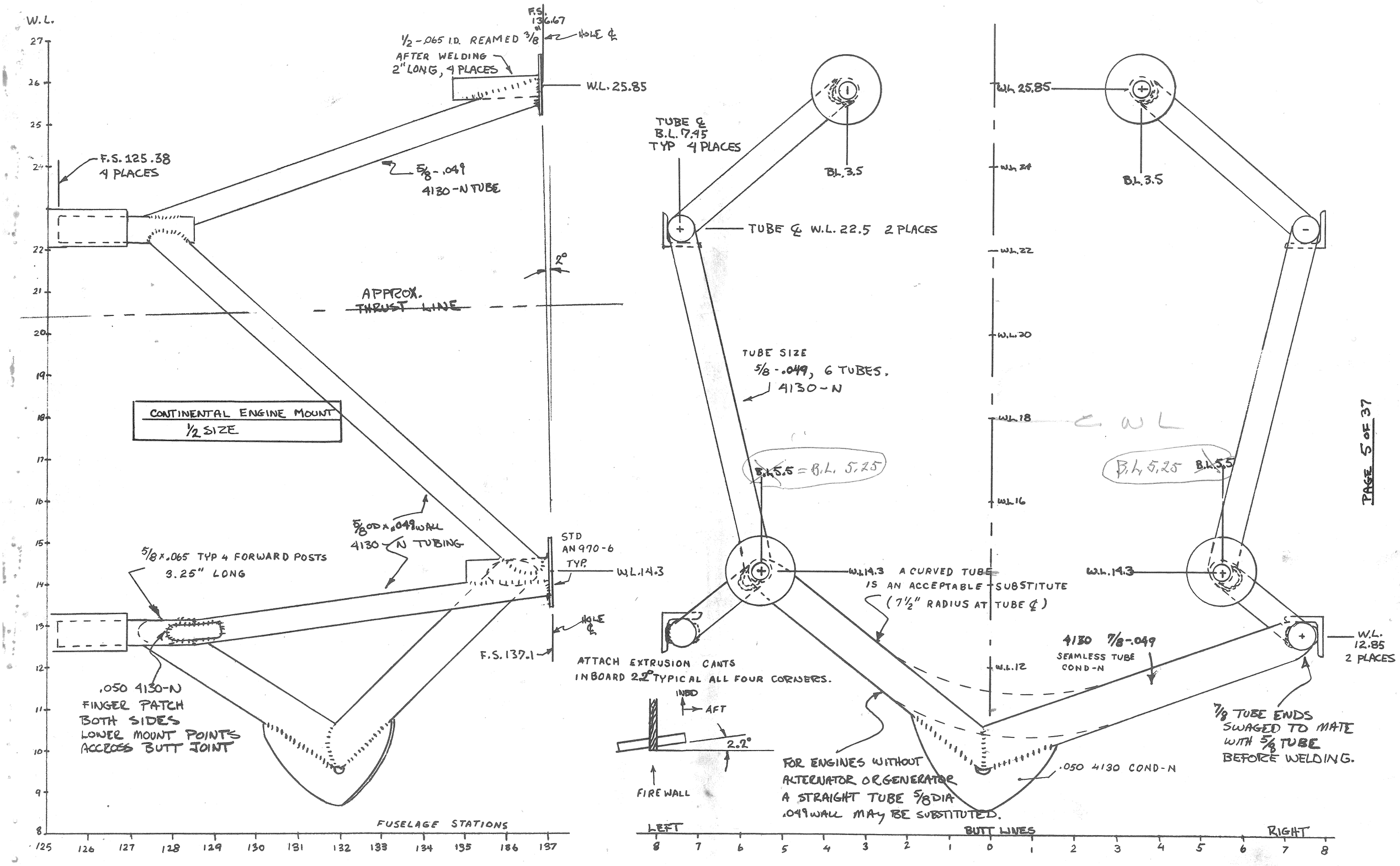
CYLINDER HEAD TEMP

WESTACH #270A6P CHT guage &#712-5W probe

EXHAUST GAS TEMP

WESTACH #270A9 EGT guage & #712-2DW probe

USE THE WIRING DIAGRAMS PROVIDED WITH EACH INSTRUMENT.


W.L.
F.S. 136.67
1/2 - .065 I.D. REAMED 3/8
HOLE ℄
AFTER WELDING 2" LONG, 4 PLACES
W.L. 25.85
F.S. 125.38 4 PLACES
5/8 - .049 4130-N TUBE
2°
APPROX. THRUST LINE
CONTINENTAL ENGINE MOUNT
1/2 SIZE
5/8 OD x .049 WALL 4130-N TUBING
5/8 x .065 TYP 4 FORWARD POSTS 3.25" LONG
STD AN 970-6 TYP.
W.L. 14.3
HOLE ℄
F.S. 137.1
.050 4130-N FINGER PATCH BOTH SIDES LOWER MOUNT POINTS ACROSS BUTT JOINT
FUSELAGE STATIONS
125 126 127 128 129 130 131 132 133 134 135 136 137
TUBE ℄ B.L. 7.45 TYP 4 PLACES
B.L. 3.5
TUBE ℄ W.L. 22.5 2 PLACES
TUBE SIZE 5/8 - .049, 6 TUBES. 4130-N
B.L. 5.5 = B.L. 5.25
ATTACH EXTRUSION CANTS INBOARD 2.2° TYPICAL ALL FOUR CORNERS.
INBD
AFT
2.2°
FIRE WALL
W.L. 14.3
A CURVED TUBE IS AN ACCEPTABLE SUBSTITUTE (7 1/2" RADIUS AT TUBE ℄)
FOR ENGINES WITHOUT ALTERNATOR OR GENERATOR A STRAIGHT TUBE 5/8 DIA .049 WALL MAY BE SUBSTITUTED.
W.L. 25.85
W.L. 24
W.L. 22
W.L. 20
W.L. 18
℄ W.L.
W.L. 16
W.L. 12
B.L. 3.5
B.L. 5.25 B.L. 5.5
W.L. 14.3
4130 7/8 - .049 SEAMLESS TUBE COND-N
W.L. 12.85 2 PLACES
7/8 TUBE ENDS SWAGED TO MATE WITH 5/8 TUBE BEFORE WELDING.
.050 4130 COND-N
LEFT
BUTT LINES
RIGHT
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8

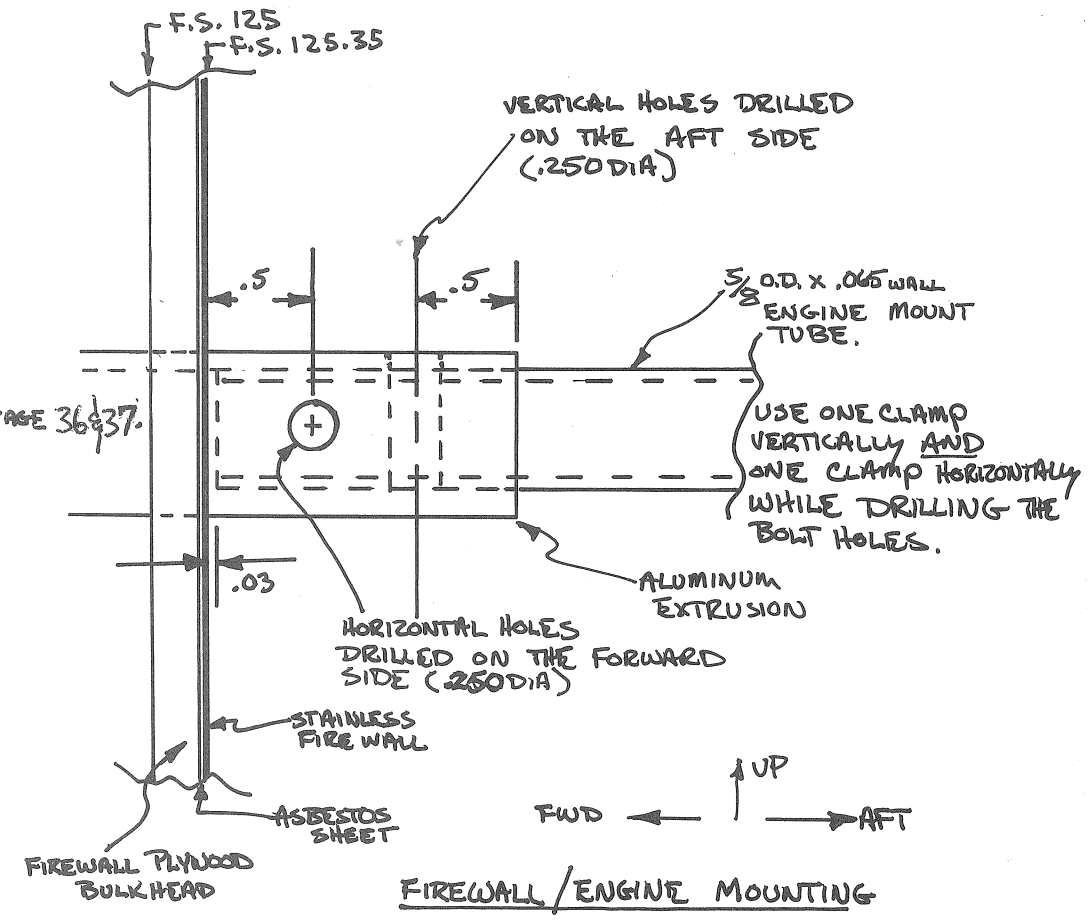
Step 3

Installing the Engine Mount

The welded engine mount assembly is available ready to install from a VariEze distributor or you can fabricate your own using the information on page 5.

First remove the 1/4" bolts and the brake actuating arms from the upper extrusions on the firewall (you installed these in section I, chapter 16). Be careful not to loose the washers or VEB1 bushings. Next push the engine mount into position as shown on page 36 & 37. You will have to spring the mount inward slightly to get it started because of the slight (2°) inward cant of the extrusions at the firewall. Space the ends of the mount aft of the firewall about .03 by using scraps of sheet metal between the firewall and the mount tubes. Clamp the tubes firmly and drill the eight mounting holes as shown. Use a long drill bit to drill the horizontal holes from the side since there isn't enough clearance from the firewall to use a standard drill bit. Use the holes already in the top extrusions as a guide to drill through. Install AN4-13A bolts on the two lower vertical mounts which bolt through the brake master cylinder mounting angles, use AN4-15A bolts on the two upper mounts which attach the brake actuating arms; the other four mount points use AN4-12A bolts. Use MS21042-4 nuts throughout and AN960-416 washers as necessary. Remove the aluminum spacers.

Once you have installed the mount be careful of the the upper mount legs; they are unsupported until the engine is installed, so don't lift the airplane with them or rest the airplane on them.

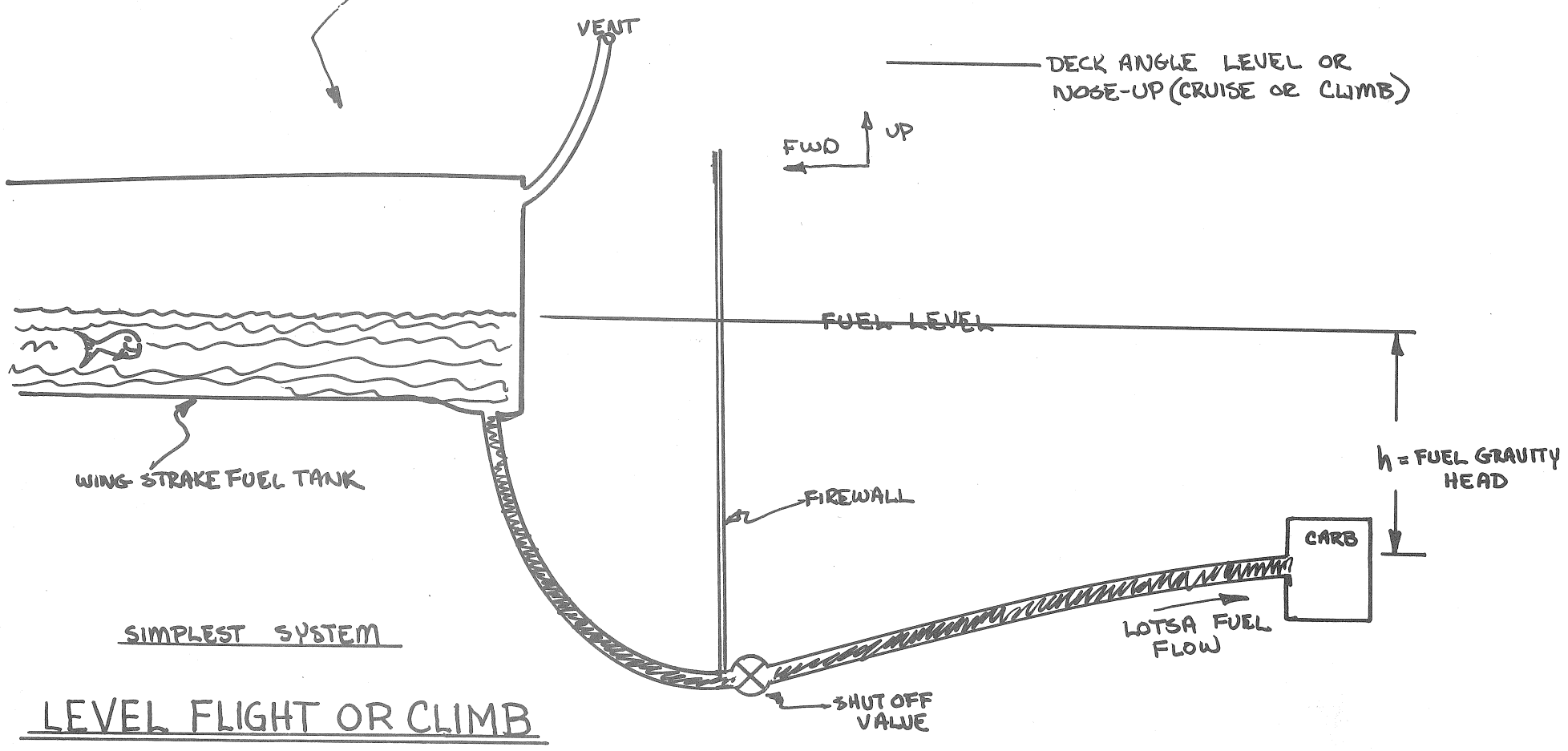


FIREWALL/ENGINE MOUNTING DETAILS TYPICAL FOUR PLACES

Step 4

The Fuel System

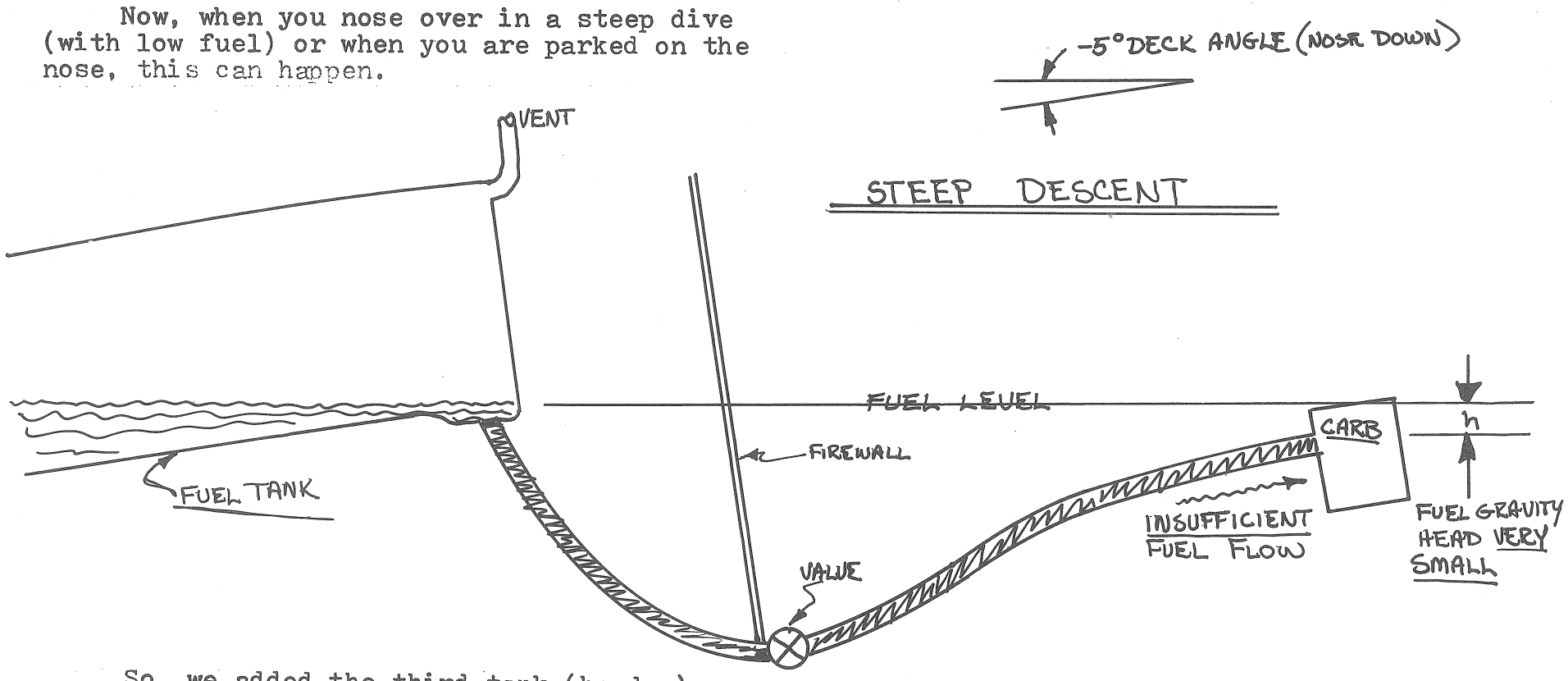
The fuel system in your airplane is unique and some of you are going to be sorely tempted to try out your own ideas. Please don't. This section is devoted to your understanding the system and how it works. Basically, the VariEze has a simple gravity-feed fuel system. Two tanks, with a common vent, feed the carburetor, but some specialized situations do exist that require a third small fuel tank. In normal cruising or climbing flight attitudes a simple gravity feed system works like this.



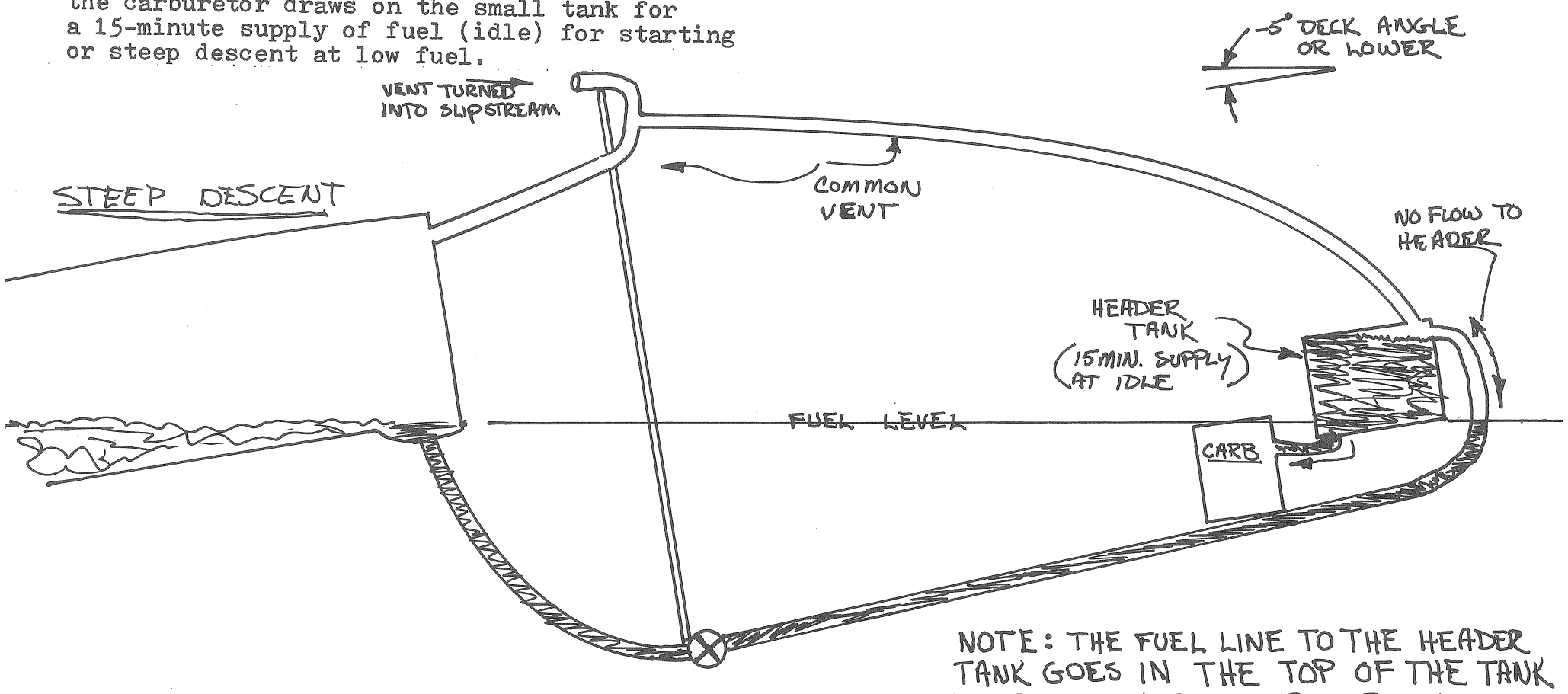
SIMPLEST SYSTEM

LEVEL FLIGHT OR CLIMB

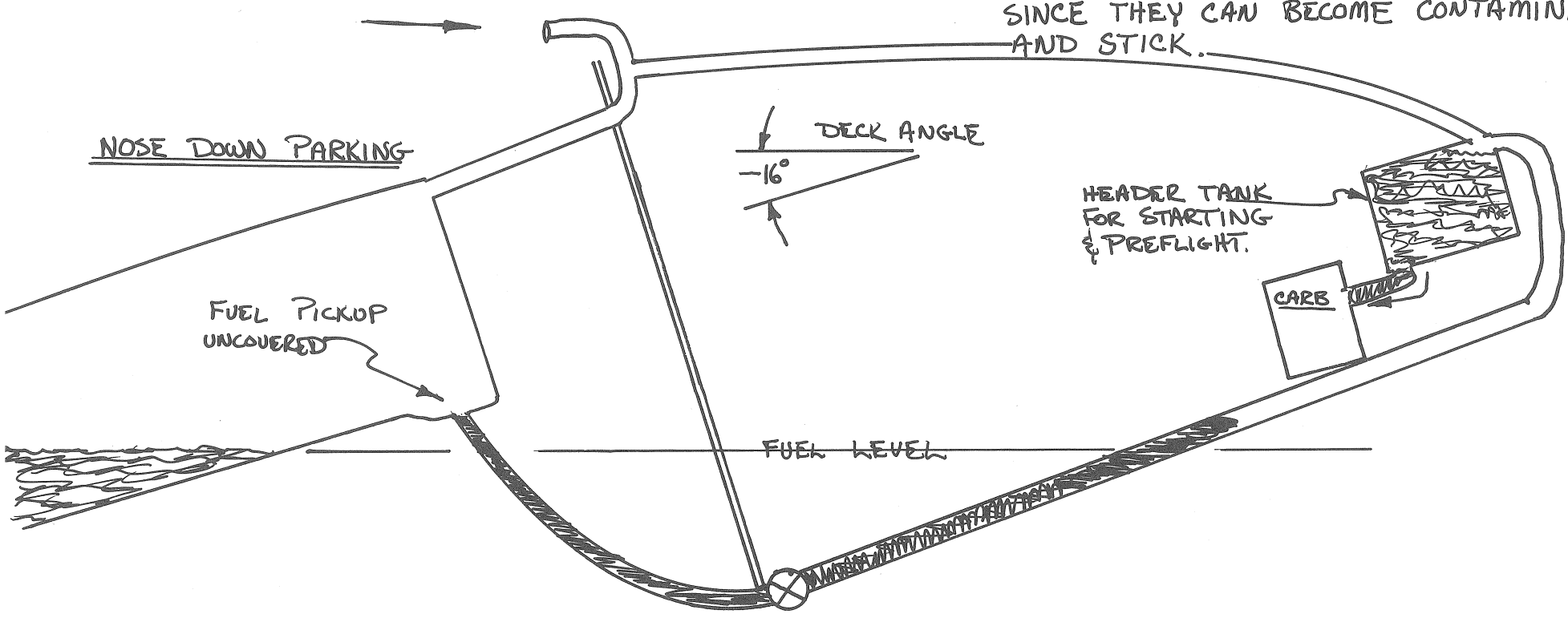
Now, when you nose over in a steep dive (with low fuel) or when you are parked on the nose, this can happen.



So, we added the third tank (header) aft of the carb. When you lower the nose, the carburetor draws on the small tank for a 15-minute supply of fuel (idle) for starting or steep descent at low fuel.



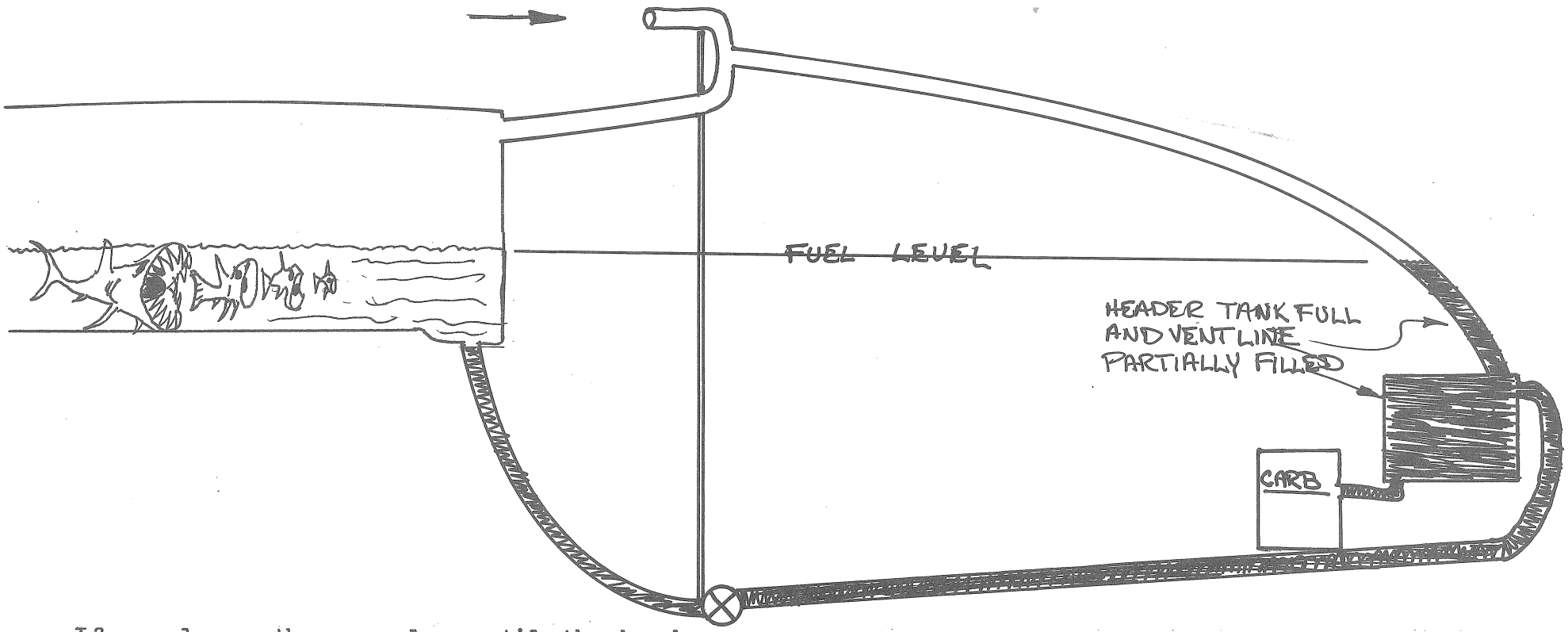
NOTE: THE FUEL LINE TO THE HEADER TANK GOES IN THE TOP OF THE TANK TO PREVENT FUEL FROM RUNNING BACK INTO THE MAIN TANKS. CHECK VALVES CANNOT BE TRUSTED SINCE THEY CAN BECOME CONTAMINATED AND STICK.



In normal flight (cruise or climb) attitudes the header tank stays full and the system is gravity feed.

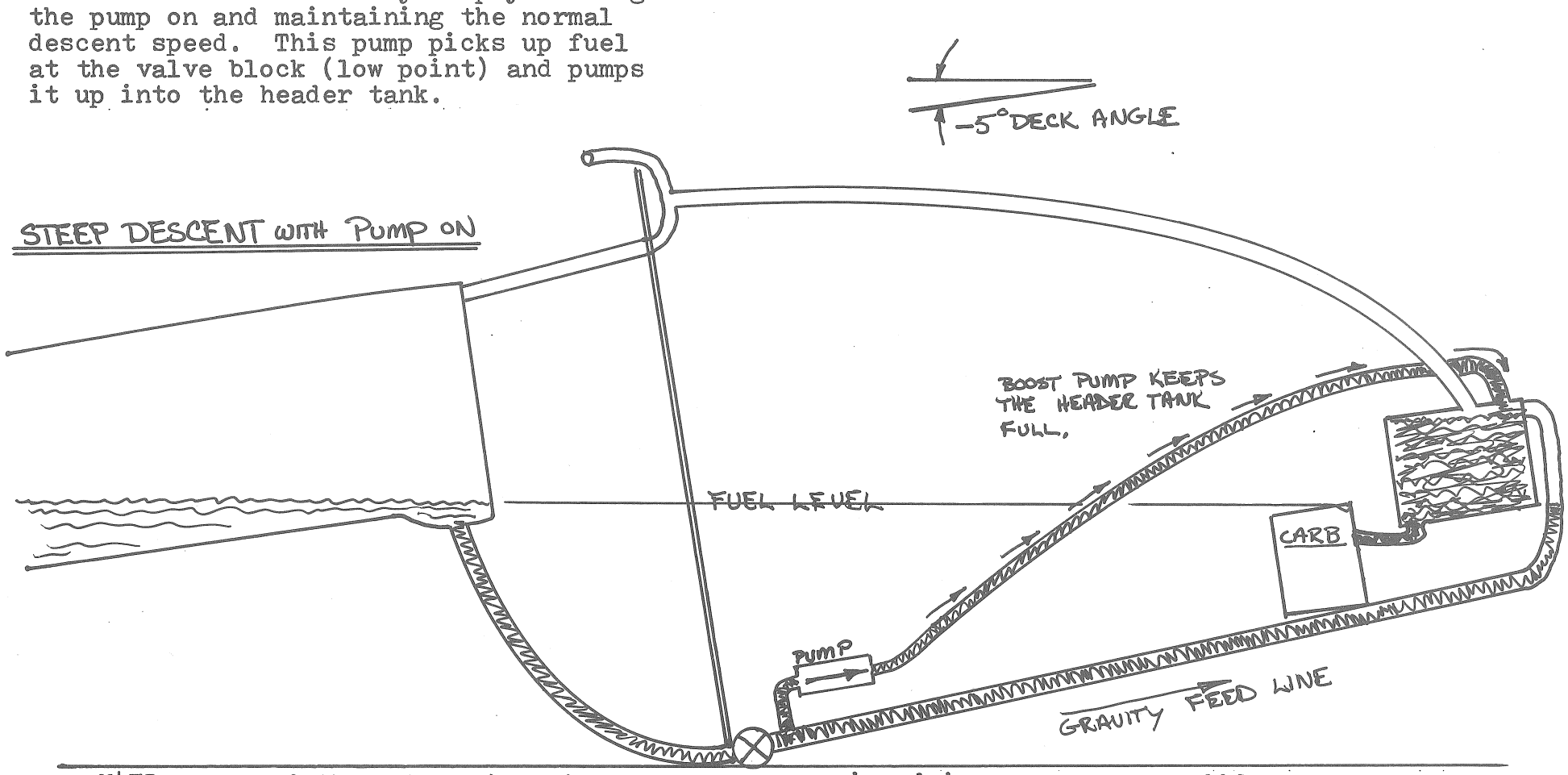
If you nose over in a steep descent at low fuel level, the header tank gives you 5 to 15 minutes of fuel supply, depending on power setting.

LEVEL OR NOSE UP



If you leave the nose low until the header tank is exhausted in a prolonged descent AT LOW FUEL LEVEL, the engine quits from fuel starvation. This sort of thing gives pilots grey hair before their time and is hard on seat cushions. To re-establish the fuel flow and restart the engine (and pilot's heart beat) the nose must be raised to level or slightly above. This means slowing to 70 to 75 kts IAS in flight. Having to slow to below normal approach speed to attain a restart at low altitude is not a satisfactory operation, even if it occurs only due to poor planning. Thus, a boost pump should be added which can keep the header tank completely full even in prolonged normal descents with low fuel quantity. Normal operations can be flown with the pump off. If the header tank is exhausted by prolonged descent with the pump off (oops!), fuel flow can be re-established in five to six seconds by simply turning the pump on and maintaining the normal descent speed. This pump picks up fuel at the valve block (low point) and pumps it up into the header tank.

The pump can be an electric pump with a switch in the cockpit so it can be turned off when in climb or cruising flight, or an engine driven pump that operates continuously, or even a pilot-driven wobble pump in the cockpit. Do not confuse this pump system with the normal pump requirements of a low wing airplane in which two pumps are required, one for a redundant backup. In the VariEze gravity is the primary fuel transfer medium, the pump needed only in rare cases to supplement gravity flow without needing to change airplane attitude. The addition of the pump does not make the fuel system a pressure system requiring a special carburetor. The pump only keeps the header tank full. Gravity feeds the carburetor. If the header tank is full, the pump simply circulates fuel from the valve to the header tank and back.



N4EZ operated throughout its first 100-hours flying without the pump. In general, the no-pump operation was satisfactory, but on two occasions the engine surged lean (increasing EGT and rough running) during high power cruise at high altitude. This is believed to be due to fuel starvation due to the small fuel head from the top of the fuel level to the header tank inlet. The pump solves this problem, thus we strongly recommend the pump be installed. Note that if you do not have an electrical system or an engine driven pump, a wobble pump can be installed. The wobble needs to be pumped only if a prolonged descent at low fuel is made, or in any case fuel starvation is suspected. It does not need to be pumped for normal operation, however, it is a good idea to pump every few minutes during a descent to assure the header tank stays full.

If your engine is not equipped with a pump and your aircraft does not have an electrical system, you can still use an electric pump and a small 2 to 4 ampere-hour motorcycle battery. The battery can be charged occasionally with a battery charger. Pump electrical drain is less than 2 amps. If the pump is run a total of only 1 minute-per-flight (once or twice during descent) the battery should need charge only about every 50 flying hours. Be sure to check the pump operation on each preflight.

Add the following information to your "Owners Manual" part IV. Write it into your manual <u>now</u> so you don't forget.

VariEze Checklist Card:

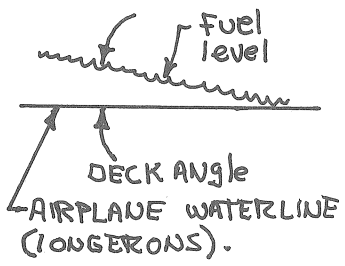
Under "Cockpit" - add "Check electric fuel pump if applicable."
Under "Descent" - add "If low fuel, run pump 30 seconds each 6 min during descent."
Under "Landing" - add "Fuel pump on".

Page 7, after paragraph 4 - add, "A fuel pump (electric, engine-driven or wobble-type) is used to provide fuel flow to the header tank at any normal descent condition. The airplane can be operated without the pump, however, without the pump if the header tank is run dry and the engine quits, the aircraft must be slowed to 70 knots to allow resumption of fuel flow."

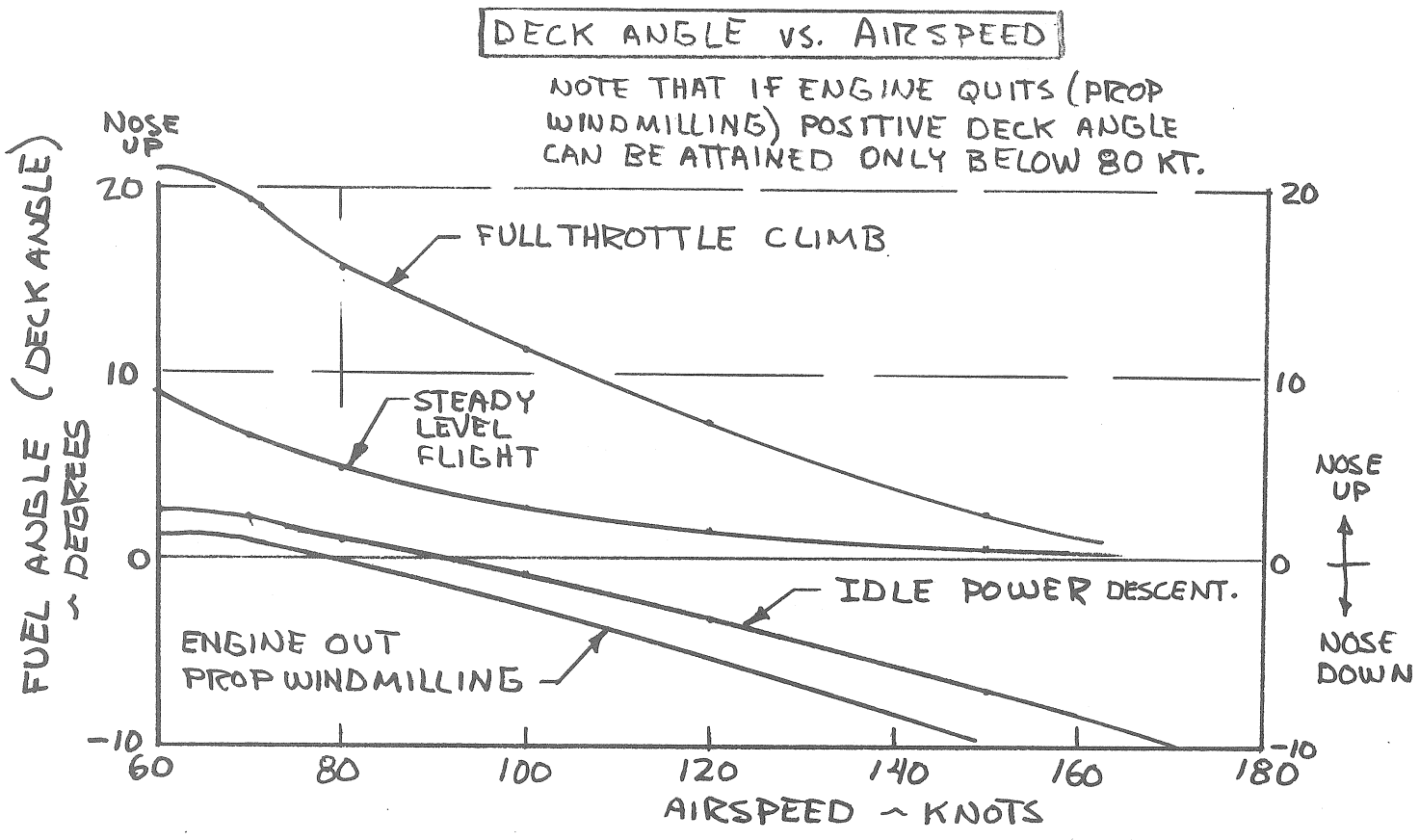
Page 15, paragraph 3, two places - add the following words between "a few seconds" and "every five or six": "(or run the fuel pump)".

Page 22, paragraph 1, after "If this occurs" - add, "turn on the fuel pump or"

Page 40, under "Each 100 Hour" - add, "check for proper operation of fuel pump."

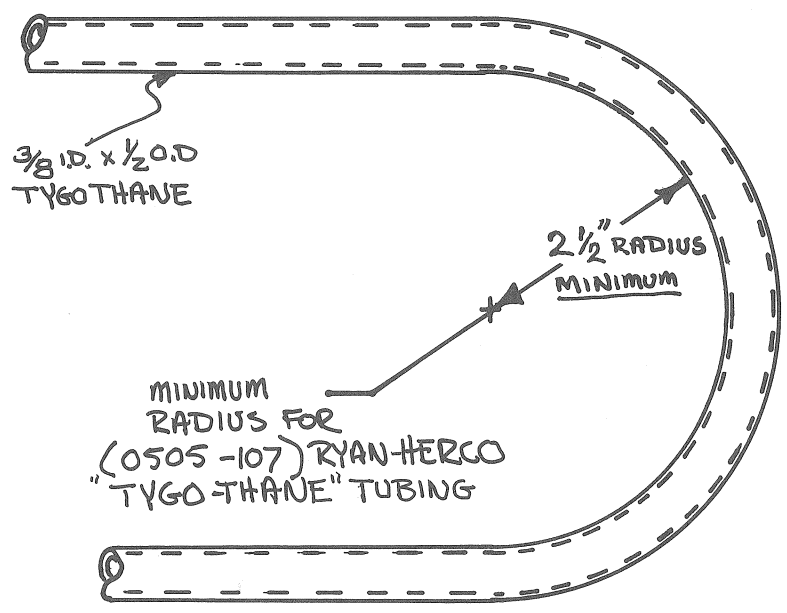


The following is a chart of Fuel attitude as a function of indicated airspeed. It can be used to determine the attitude of the Fuel with respect to waterline (and fuel gravity head) at any combination of power and airspeed. Use it to help visualize the flight conditions which correspond to the fuel system schematics on the preceeding pages.

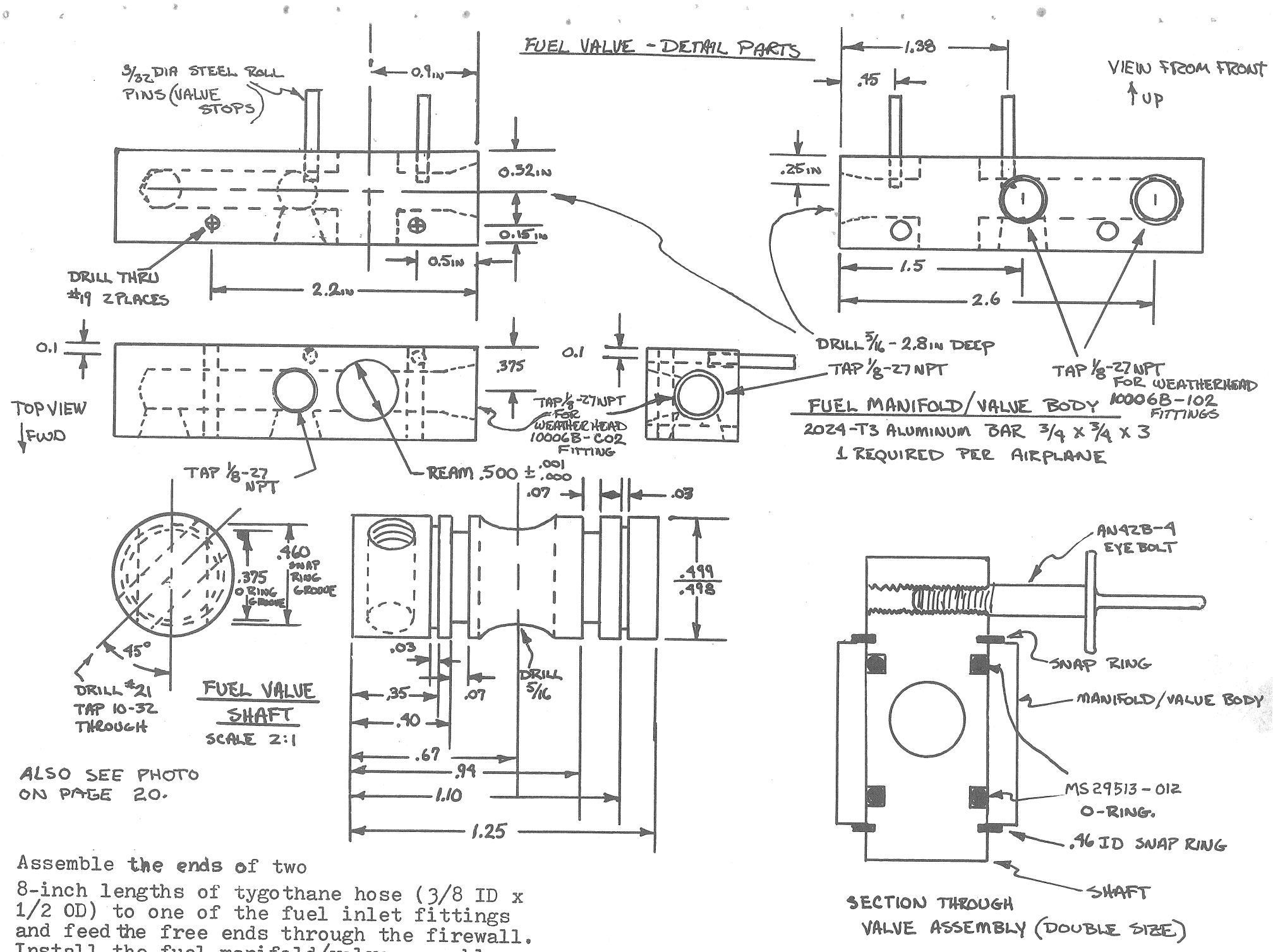


Fuel System Plumbing

All of the fuel system components used here are available from a VariEze distributor, ready to be installed. Engineering drawings are provided here for fuel manifold/valve assembly for those who wish to make their own. Extensive use is made of tygothane polyurethane tubing (0505-107), compound C-210-A. Combined with WEATHERHEAD AND RYAN-HERCO LOW-COST fittings using safety wire for clamps, the system results in a considerable cost and weight savings over blue AN fittings and standard aircraft hose. The only disadvantage is that reasonable care must be used to avoid tubing kinks. Be sure you support the tubing well and make no bends with a radius less than 2-1/2 inches. <u>Do not</u> substitue clear vinyl, polyethylene, polypropyelene, or tygon tubing. They are not near as tough and they get brittle at low temperatures. Tygothane has a tensile strength of 5900 psi and avoids low temperature brittleness down to -100° F.

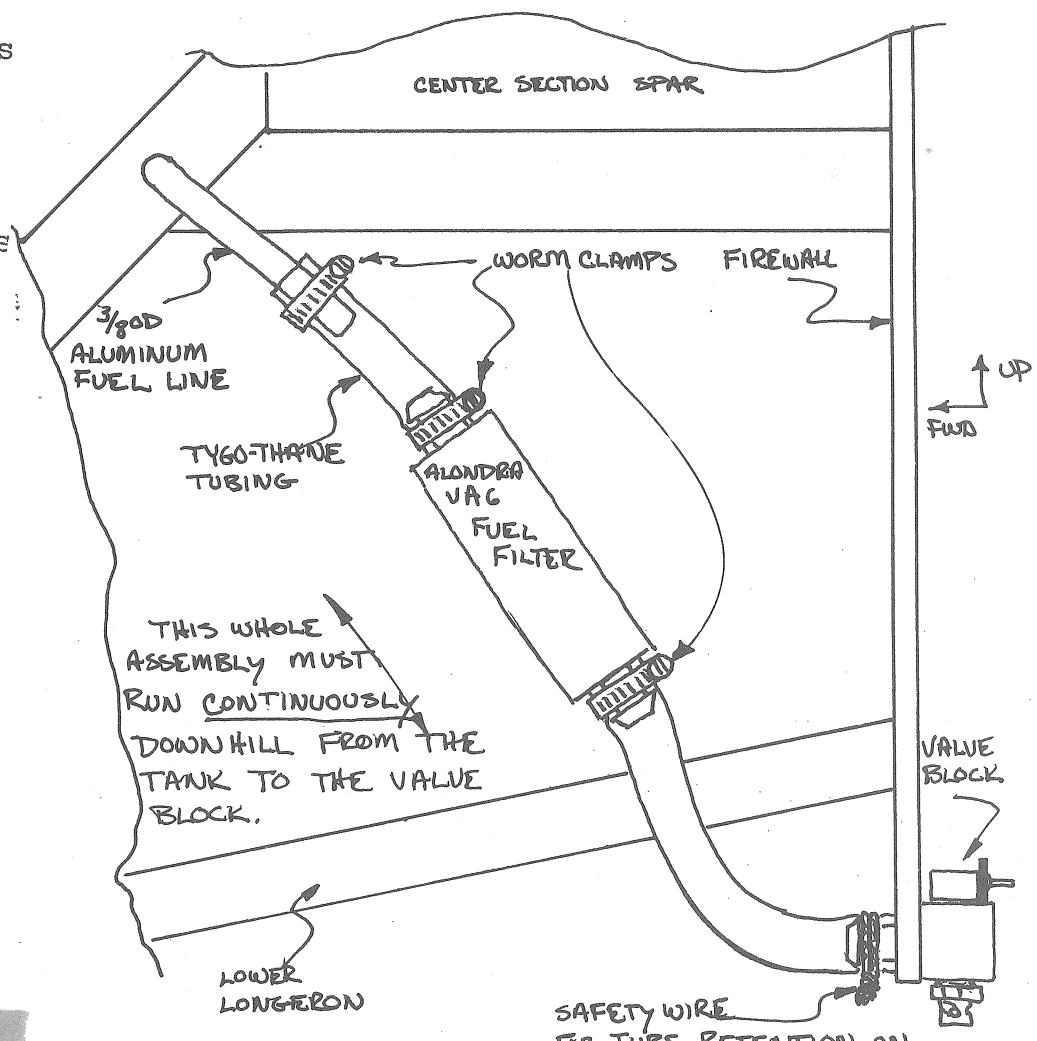


First, either fabricate or puchase the fuel manifold/valve assembly shown on PAGE 10. LOCATE the assembly on the center of the firewall as shown and drill two 1/8" holes through the plywood using the small mounting holes in the manifold/valve assembly as a guide. Drill two 9/16" dia holes through the firewall centered over the two 1/8-27 NPT tapped ports to allow the fuel lines and fittings to penetrate the firewall. Install the two fuel inlet fittings to the manifold/valve assembly. Install the 90° fuel outlet fitting in the end of the manifold and a fuel quick-drain fitting in the bottom tapped port. Use teflon tape to seal the threads of each fitting on installation.

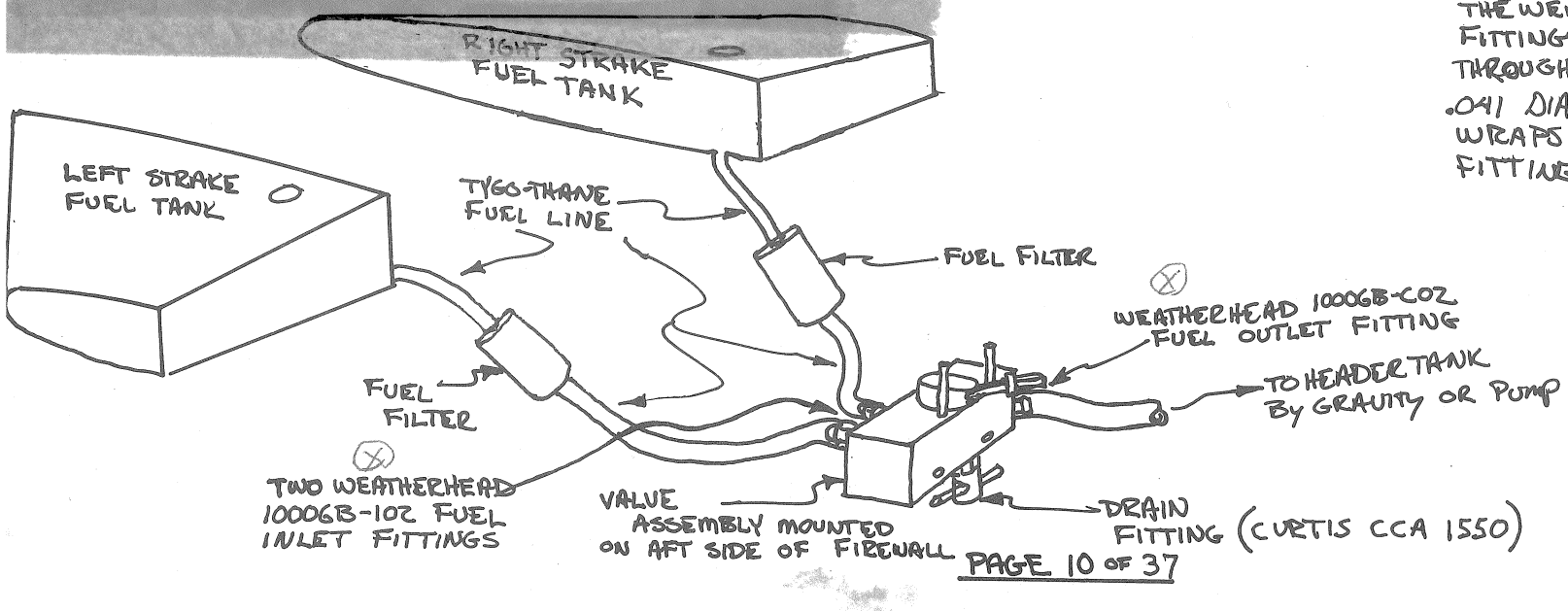


ALSO SEE PHOTO ON PAGE 20.

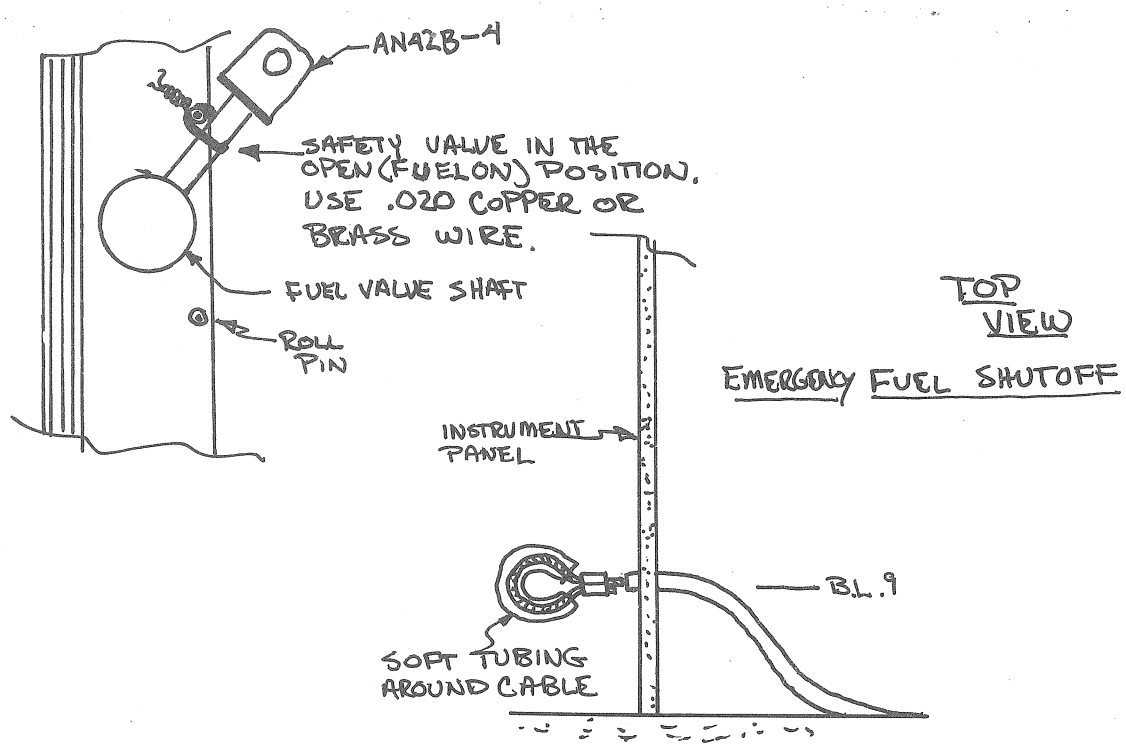
Assemble the ends of two 8-inch lengths of tygothane hose (3/8 ID x 1/2 OD) to one of the fuel inlet fittings and feed the free ends through the firewall. Install the fuel manifold/valve assembly to the firewall using two AN526-632-R24 screws with AN365-632 nuts and AN960-06 washers. Install fuel filters (Alondra VA6) on the free ends of both fuel inlet lines using small worm-type clamps for hose retention. Install a length of tygothane hose from the aluminum fuel lines to the filters using clamps on each end. Double check that you have the filter inlets on the upstream (tank) side of the line (downhill, no loops, free of rudder cables). Note that worm clamps are used on the filter to allow easy removal. Cut a 9-foot length of 1/16" control cable and assemble one end (18-1-C sleeve and AN100-3 thimble) through the eye of the AN42B-4 bolt in the valve assembly. Feed the free end through a nylon conduit to the instrument panel and make a pull ring as shown using a short piece of soft rubber hose andan 18-1-C sleeve. This pull ring must be small enough to be out of the way. The pull ring should be tight against the instrument panel with the valve in its full open (right) position. The shutoff valve must be safetied in the full open position for normal operations as shown, but this can be done following your initial fuel system flow checks. Don't forget!

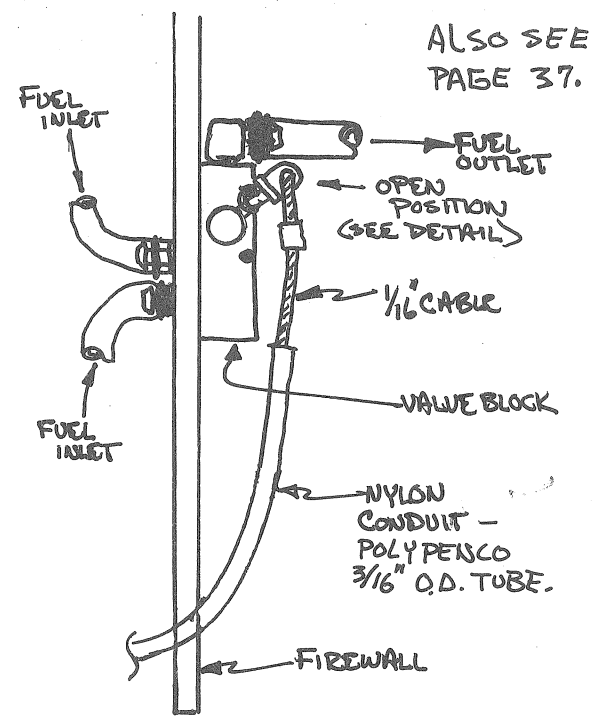


All three weatherhead fittings must be drilled out to an inside diameter of .281 (9/32) to increase fuel flow.
top right, 10-5 should be 10-3.



ALSO SEE PAGE 37





Step 5

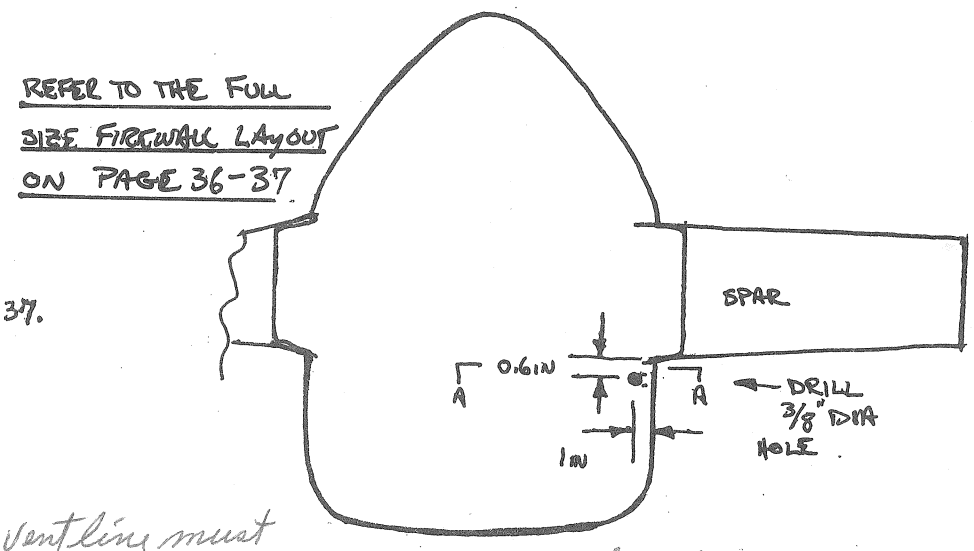
Vent System Plumbing

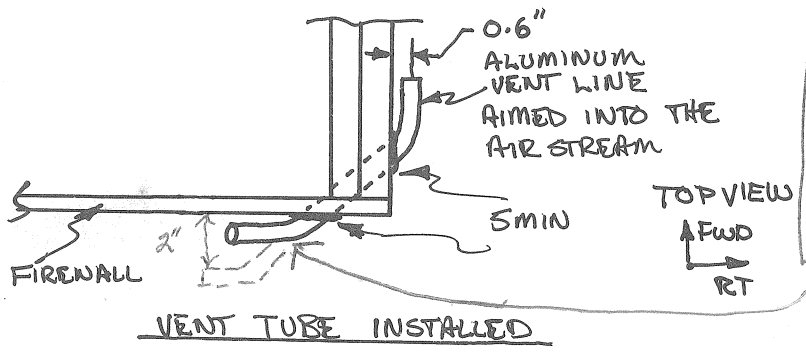
First drill a 3/8" hole through the firewall as shown, angled outboard to allow the cowling to clear the vent line.

Cut a 6" length of 3/8" OD 3003-0 aluminum tubing and 5MIN it into position as shown.

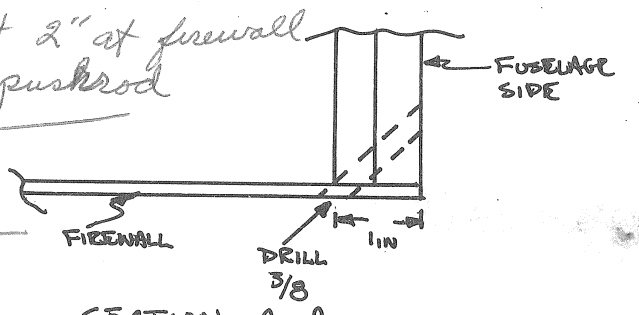
Install Ryan Herco tygothane clear tubing 0505-107 (3/8 ID - 1/2 OD) and 0715-020 tees as shown to complete the vent system on the firewall. SEE THE FULL SIZE DRAWING PAGE 36 & 37.

The vent line to the header tank is installed later after the header tank and engine are mounted permanently. Use loops of .041 safety wire through the firewall to mount the 0715-020 tees firmly in place.





Vent line must extend aft about 2" at firewall to clear aileron pushrod



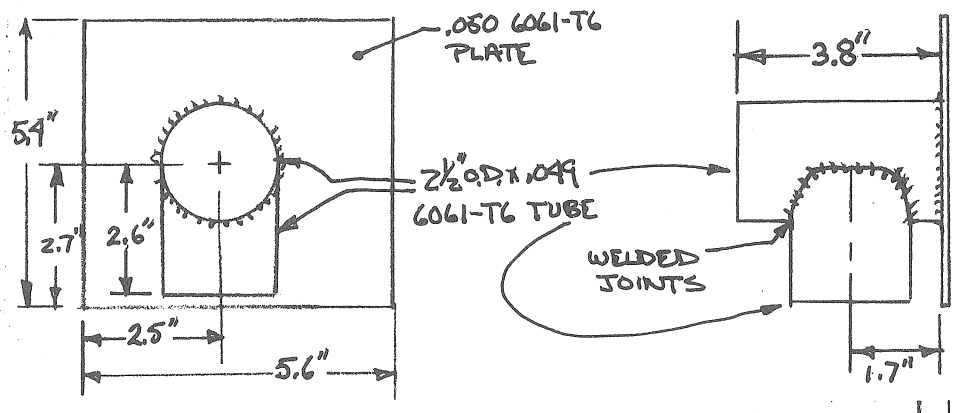
Step 6

Installing the Carburetor Air Filter and Valve

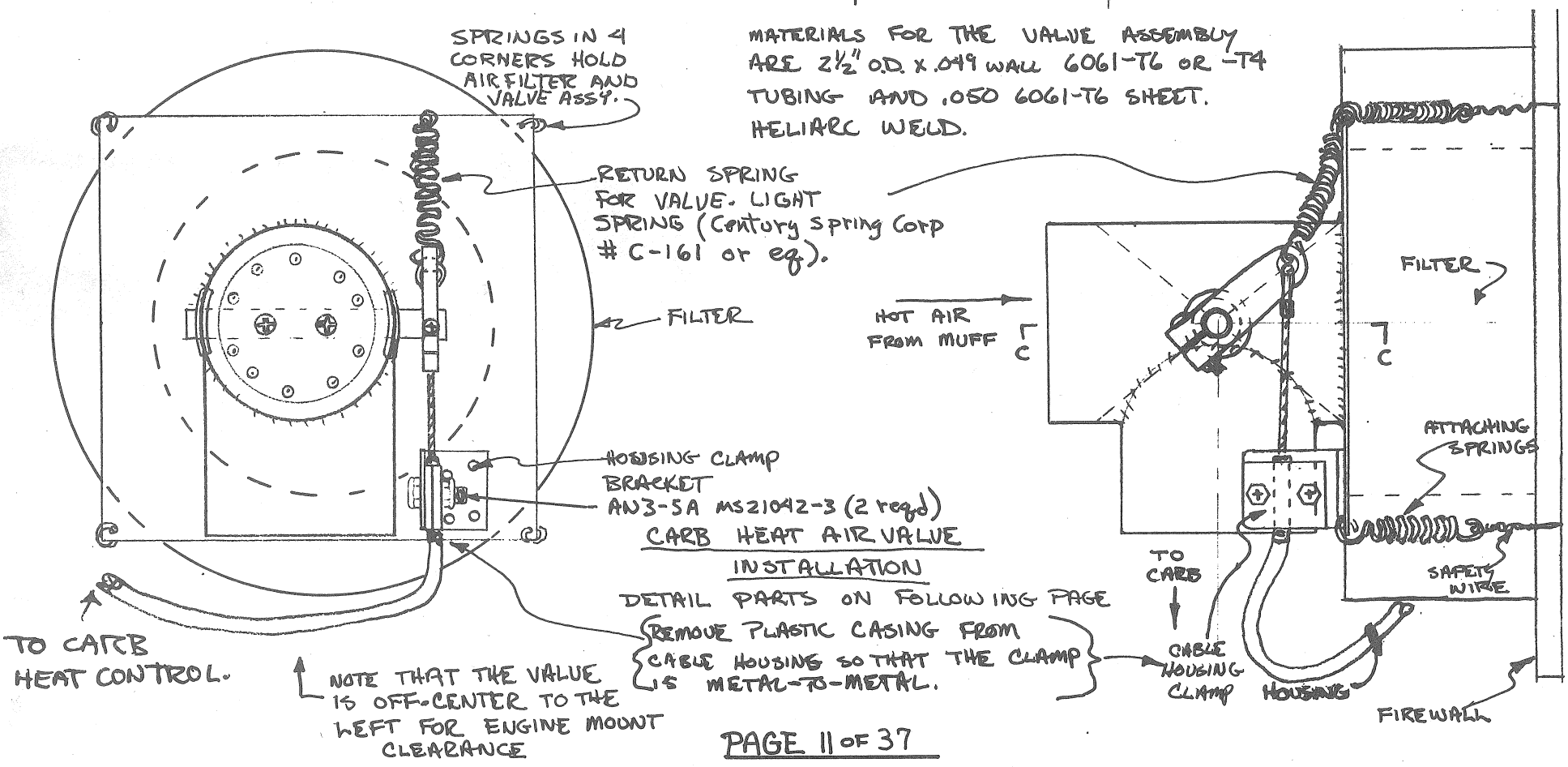
You need to go down to your auto parts store and get a purolator #AFP-117 or an A.C. 448C air filter.

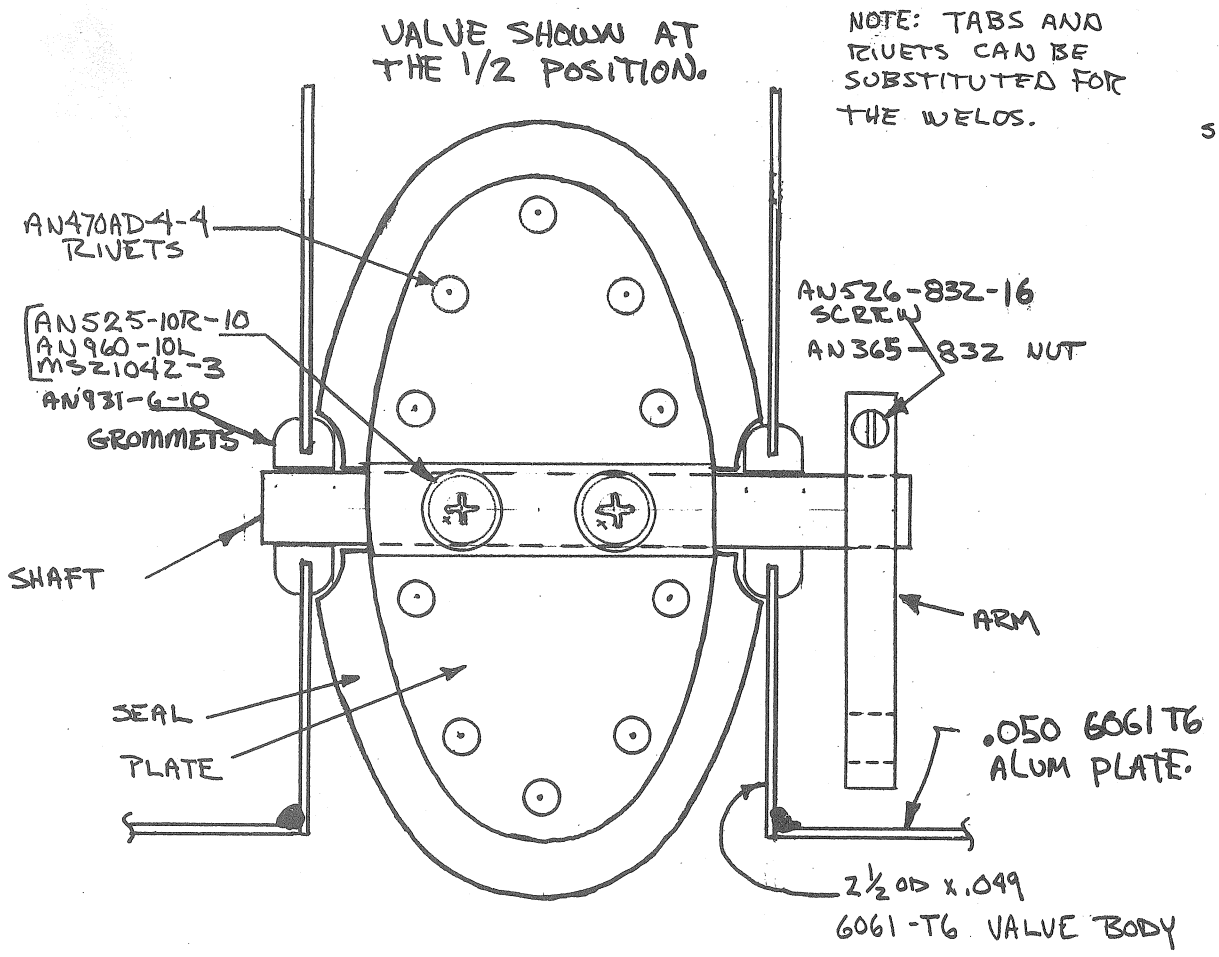
Locate your filter on the firewall low and to the far left as shown ON PAGE 37, BUT DON'T LET it chafe on the brake line, throttle quadrant cables, or the fuel valve block. Draw around the outside of the filter and then set it aside. Next fabricate the air valve shown below AND ON PAGES 12 AND 37.

AIR VALVE BODY

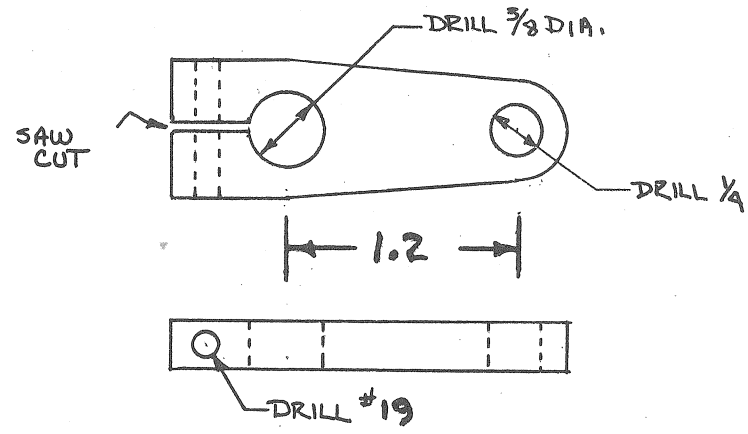


MATERIALS FOR THE VALVE ASSEMBLY ARE 2½" O.D. x .049 WALL 6061-T6 OR -T4 TUBING AND .050 6061-T6 SHEET. HELIARC WELD.

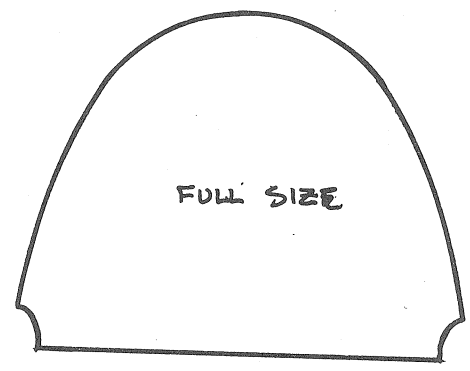




CARB HEAT VALVE ASSEMBLY

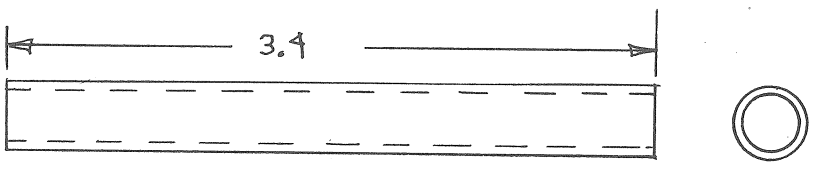


VALVE ARM USE .25 THICK 2024-T3 ALUMINUM. 1 REQUIRED.

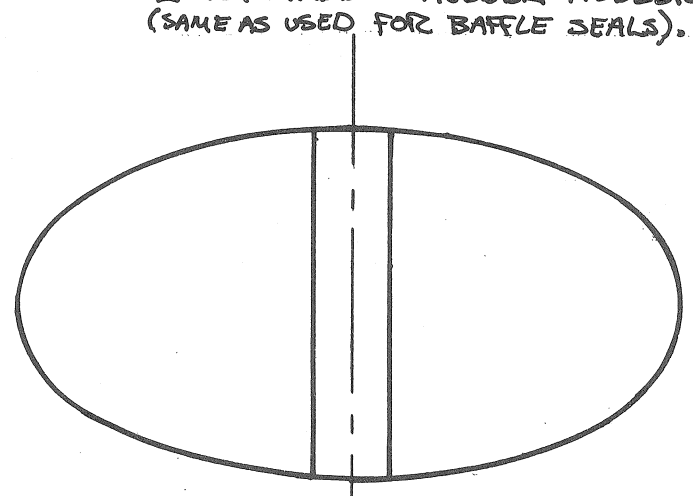


HEAT VALVE SEAL
2 REQUIRED RUBBER ASBESTOS
(SAME AS USED FOR BAFFLE SEALS).

SECTION C-C
FULL SIZE

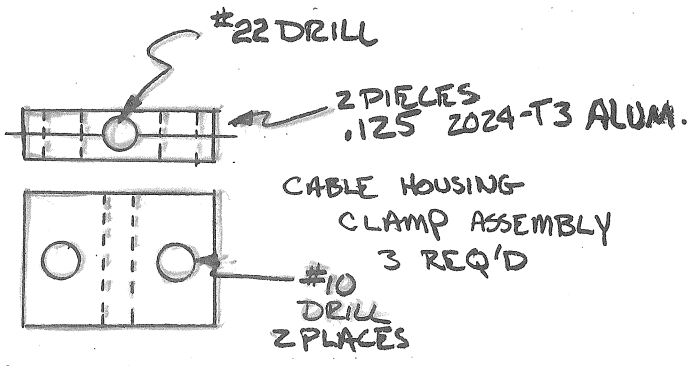


HEAT VALVE SHAFT - 1 REQ'D 3/8 O.D. x .049 WALL
2024-T3 TUBE

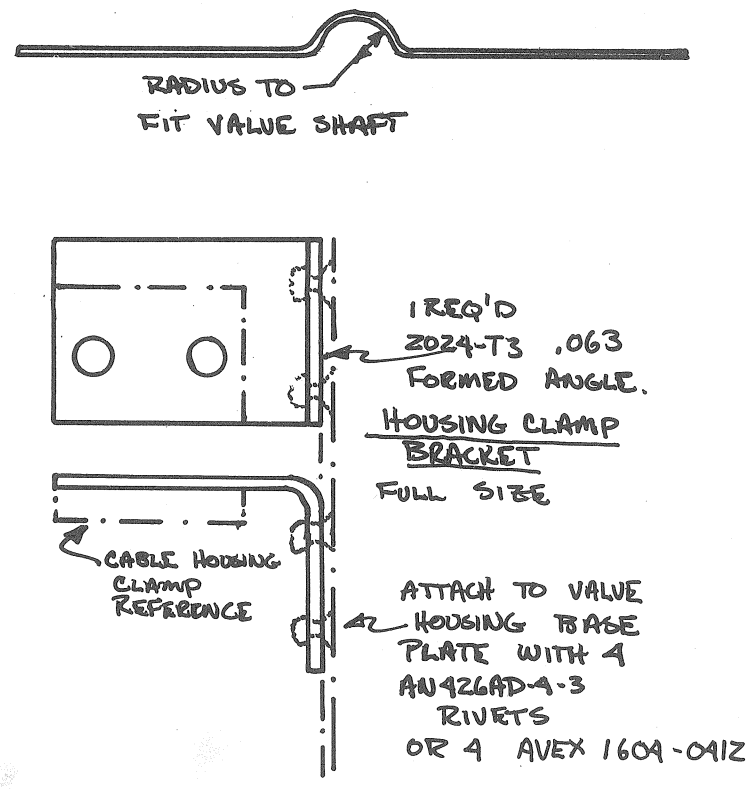


HEAT VALVE PLATE 2 REQ'D
.025 6061-T6 ALUMINUM
FULL SIZE

FULL SIZE



MAKE 3 ASSEMBLIES, USE ONE FOR THE HEAT VALVE. THE OTHER TWO ARE FOR THROTTLE AND MIXTURE (STEP 14).



Locate your air valve over the outline of the filter so the four corners overhang it equally and mark the location of the four corners on your firewall. Drill two small holes (1/16") through the firewall and make a loop of .041" safety wire through them as shown at all four corners.

Cut four lengths of 3/8 OD screen door spring as shown and install the airfilter and air valve as shown with the springs holding the valve and filter tightly against the firewall at all four corners.

Step 7

Go back to section I, chapter 23, step 2, and install the bottom cover. CHAPTER 23, STEP 4 (SIDE CONSOLES) MAY ALSO BE COMPLETED AT THIS TIME.

Step 8

Mounting the Engine

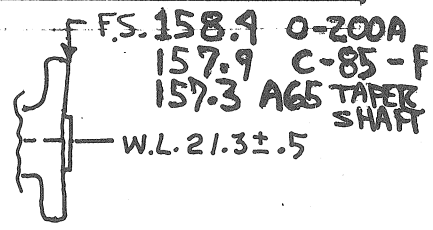
This step requires either two or three strong friends or an engine hoist.

Load the front cockpit area with ballast (or your spouse) so the airplane doesn't tip over when you have the engine on the mount. Pick the engine up (or hoist it), hold it into position, install the shock mounting parts, attachment bolts, and nuts listed below. Be sure to have the correct mounting parts for your engine. Be careful not to bash your engine mount and engine accessories as you fit the engine up to the mount. Support the engine weight until all four bolts are in place with nuts on.

Engine Mounting Parts

TYPE ENGINE	PARTS NUMBER REQ'D	CONTINENTAL PART NO.
0-200-A	8	530626 seat
	8	530741 cup
	8	530740 bushing
or	4	53027 spacer ~~530627~~ 530627
	4 pieces	1.5 long AN~~844~~-8-6 hose 834-8-6
	4	AN6-55 bolts
C-90-14	4	AN310-6 nuts (180-190-in lbs)
	4	Cotter pins
A-65, A-75,	8 ea	22387 bushings
A-80, C-75,	4 ea	21530 washer
C-85, C-90,	4 ea	AN6-45 bolt
all except	4 ea	AN310-6 nut
C-90-14	4	cotter pins

THIS IS THE POSITION OF THE PROP FLANGE AFTER THE 3-INCH EXTENSION HAS BEEN ADDED. THIS IS AT 1 g AND INCLUDES THE SAG OF THE ENGINE ON THE RUBBER MOUNTS.



Step 9

Air Induction System

First dig into your box of foam scraps and make up a rough block of green urethane 3"x5"x6". All of the foam is carved away later so don't go overboard gluing blocks together. Glass one side as shown with four plies of BID (scraps) using RAEF.

Let this layup cure. Carve the foam block to the shape shown for the inlet.

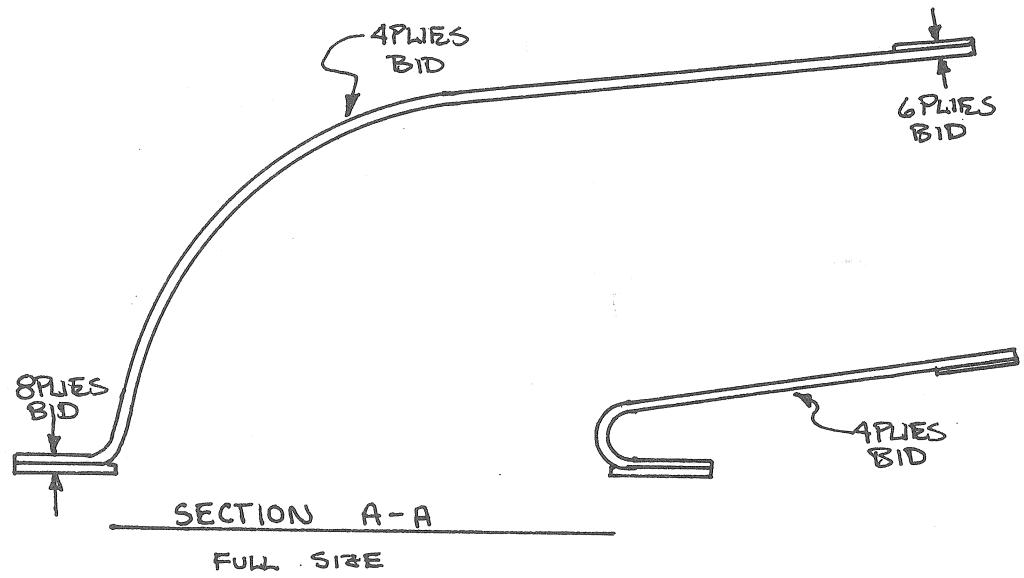
Glass with four plies BID. Overlap the glass onto the cured layup about 1" all around. Add a two-ply tape around the lip of the inlet as shown.

Let the layup cure. Trim to the configuration shown below. Remove all of the foam, open a 2-1/2" dia hole through the bottom, and drill the hole pattern shown for mounting to the carburetor.

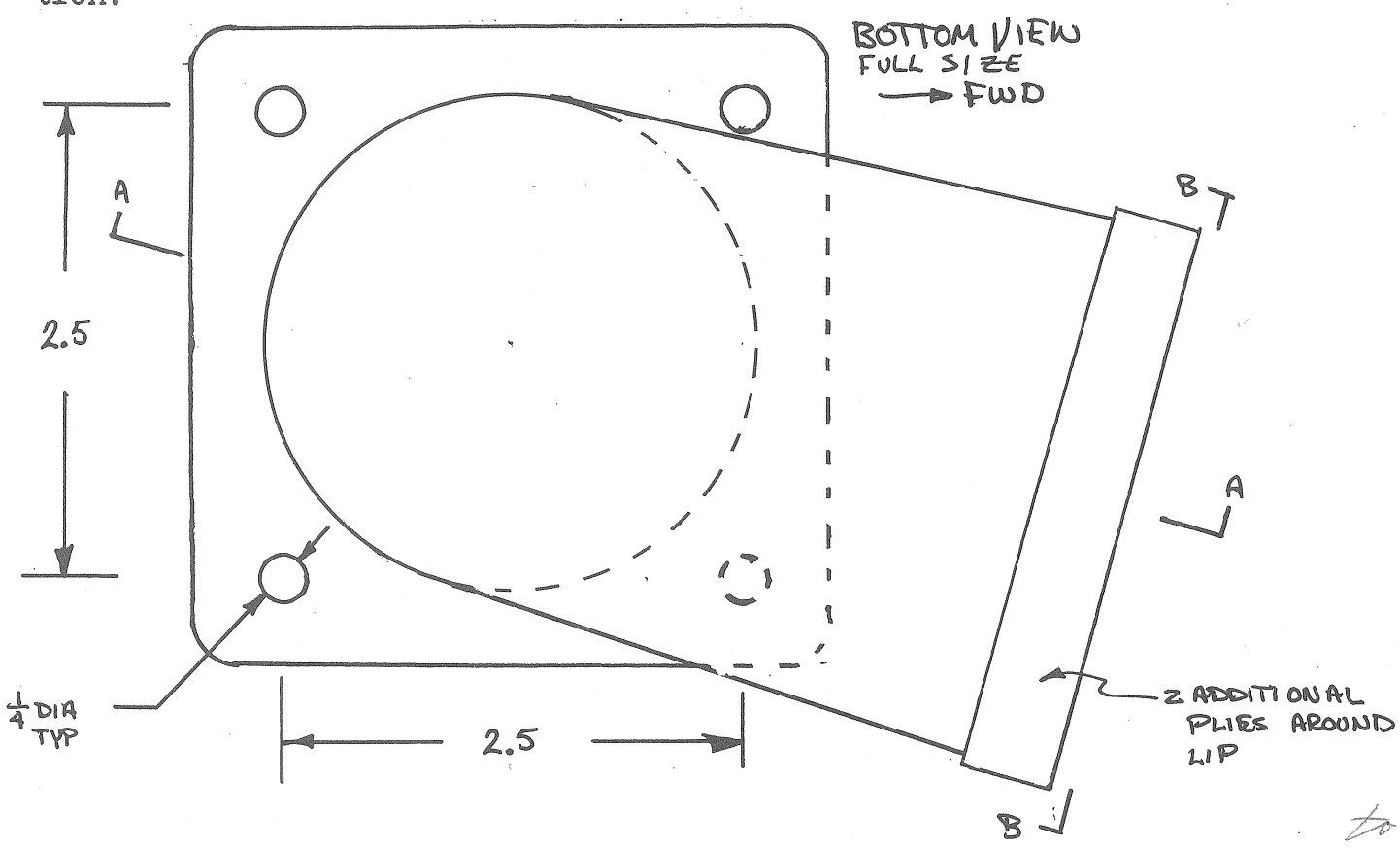
Install your inlet flange on the carb. Use a gasket sealing compound to seal it (not silicone rubber or bathtub caulk) against leakage. THE SEALANT MUST BE FUEL PROOF.

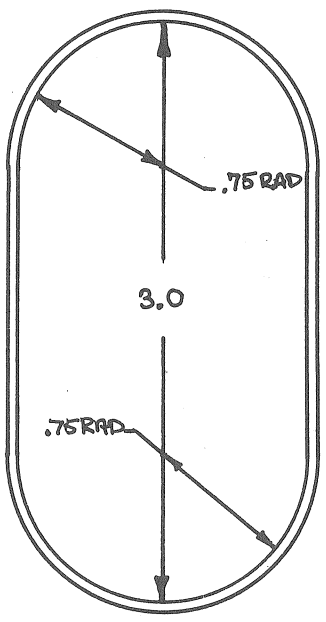
Next mount your CAT-10 (black) inlet hose to the flange. Pay careful attention to the clamping details shown (NEXT PAGE).

Route the inlet hose UNDER the oil tank to the air valve and clamp it in place similar to the detail shown. The inlet hose should not be stretched tight. A little slack is required to allow for engine movement in operation.



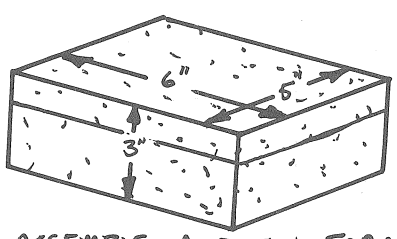
CARB AIR INLET FLANGE



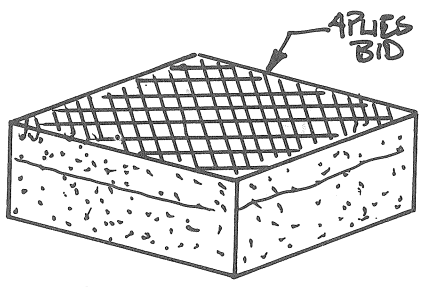


SECTION B-B

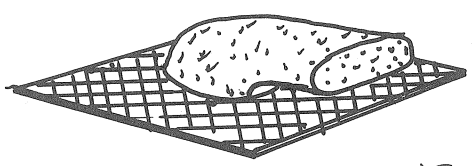
drill 1/4" hole in the low point of the air inlet hose to drain fuel for a flooded start (low point with gear retracted)



ASSEMBLE A 3x5x6 FOAM BLOCK FROM SCRAPS



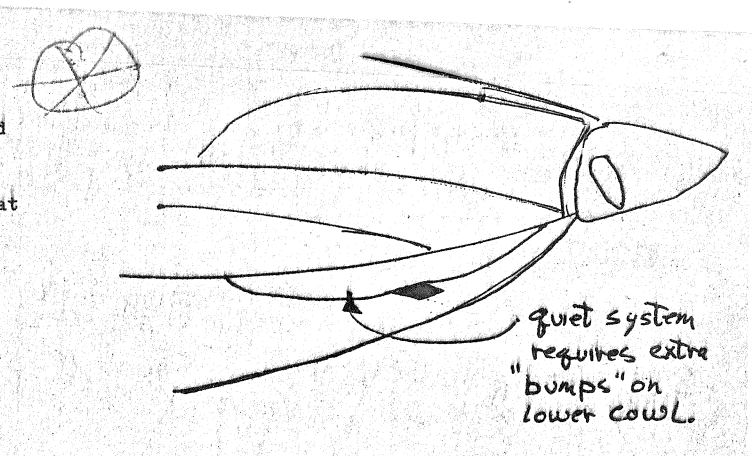
GLASS ONE SIDE AND LET CURE

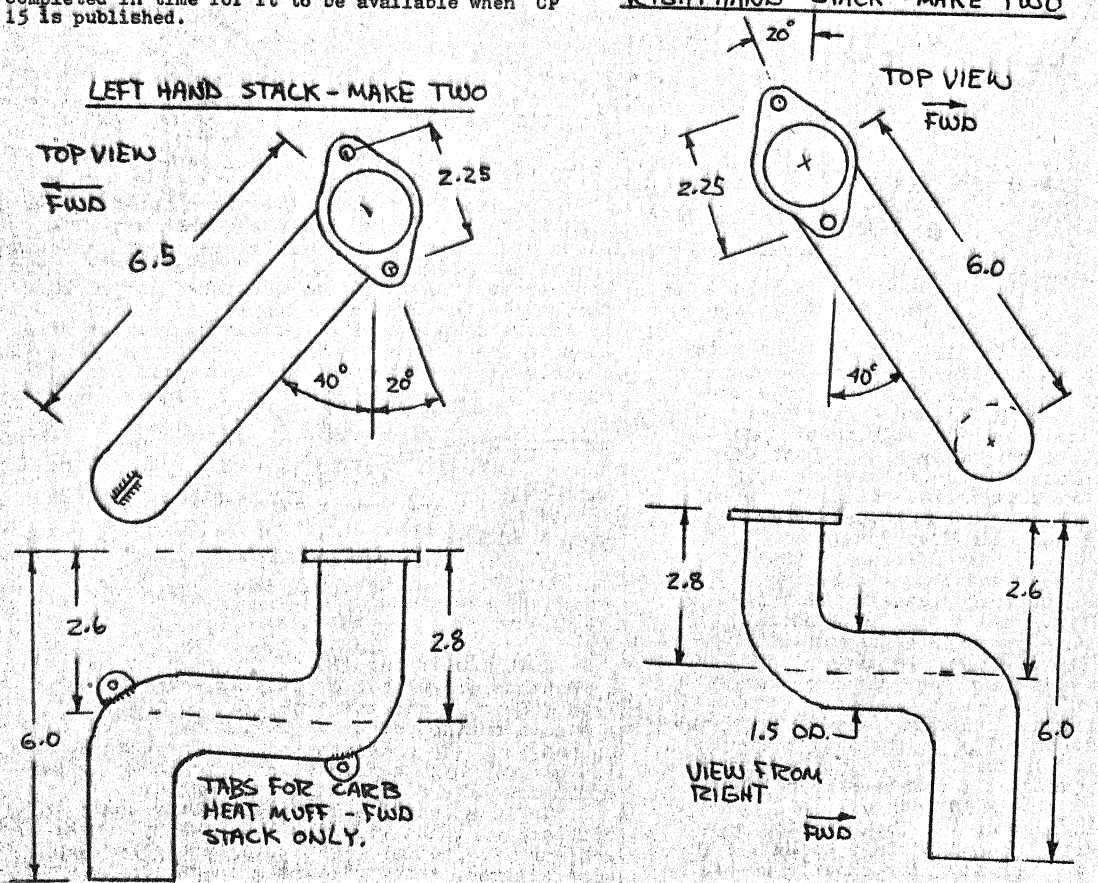


SHAPE A PLUG TO THE SIZE SHOWN ABOVE. GLASS OVER EVERY THING WITH 4 PLIES BID. USE SCRAPS AND SMALL PIECES.

VARIEZE EXHAUST SYSTEM - As you know from CP 13, the four-post exhaust system had to be shortened to avoid vibration failures. CP 13 instructed you to shorten your system but did not have a drawing showing all details. The drawing below shows what the system looks like after shortening. Note that it must fit rather tight on the intake manifold to allow adequate cowling clearance. If you have an original-length system from mild steel, saw out a portion of the horizontal length and take it to a welder to get it welded - most auto muffler shops can do an adequate weld on mild steel tube.

The quiet muffler system mentioned in CP 13 has been flown on N4EZ. It is very quiet, weighs about 8 lb, but presently robs too much engine power. The manufacturer is now modifying it to lessen the power loss. Installation of the two-can muffler system requires "bumps" to be added to the lower cowl (see SKETCH). It is similar to a Cessna 150 in external configuration, but has far superior sound deadening qualities. We hope to have its development completed in time for it to be available when CP 15 is published.



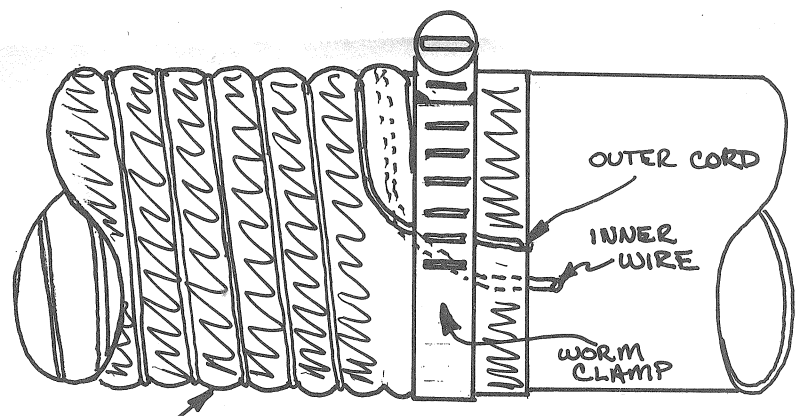


Step 10

Exhaust System Installation

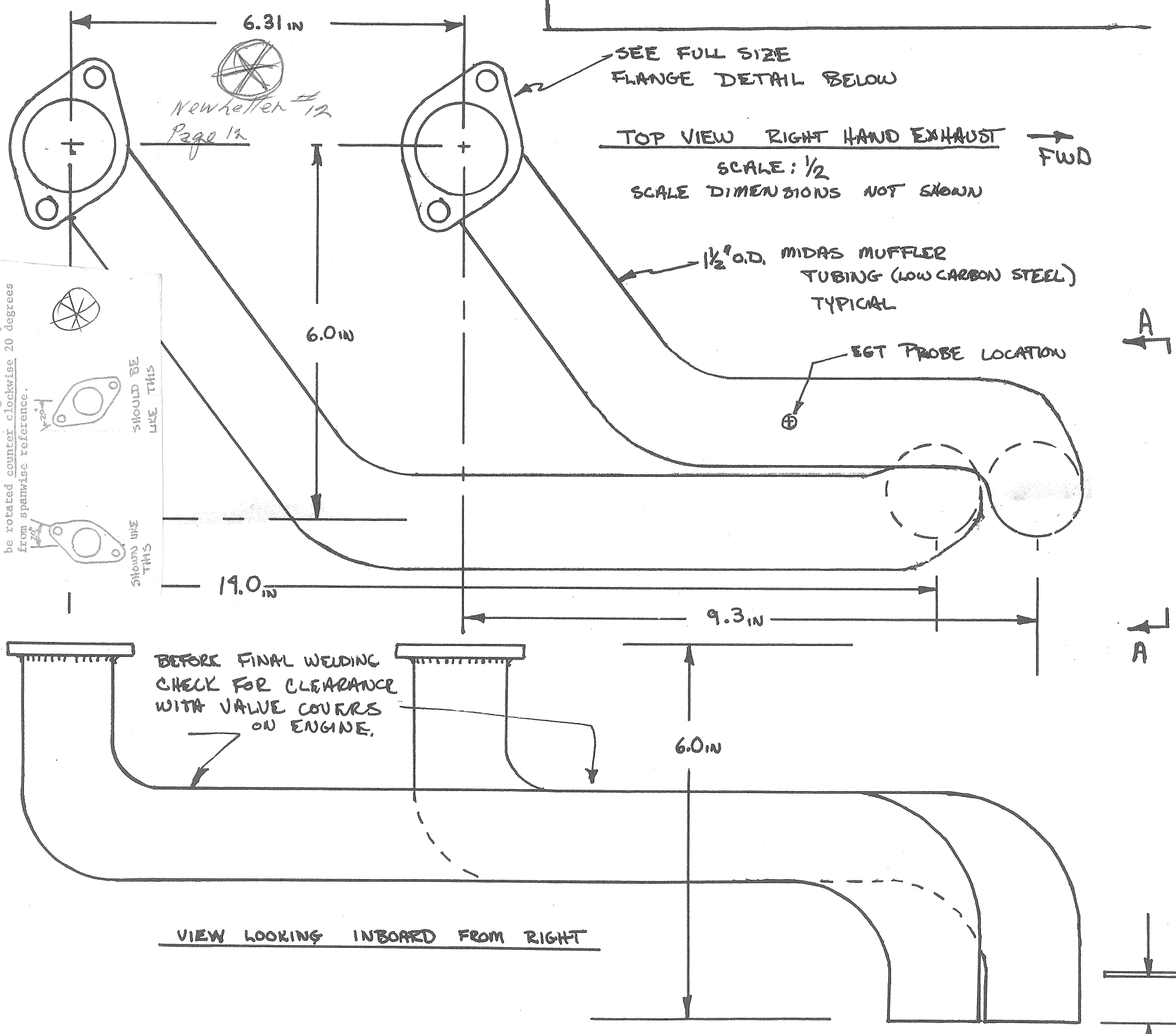
Half-size scale drawings of the four exhaust pipes are shown below.

Use Continental exhaust gaskets (part no. 530162) on final installation. For initial fit-up purposes, don't use your gaskets. The inital "set" taken by the gaskets when the flange is torqued down provides a custom seal for that exhaust pipe and several cycles of installation and removel reduces the effectiveness and life of the gasket. Use 5/16 x 24 brass exhaust manifold nuts with AN960-516 washers (8 ea) for final installation.



AEROQUIP FLEXIBLE AIR DUCTING SCAT OR CAT TYPES (DO NOT substitute CEET OR SCEET HOSE)

FLEX HOSE CLAMPING DETAIL

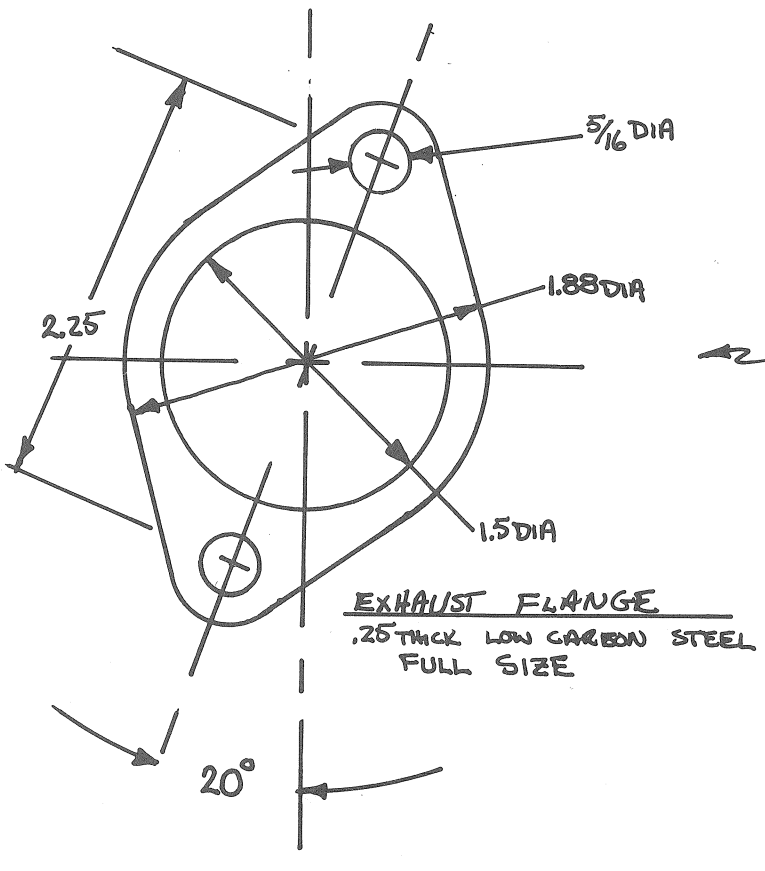


Newkeller #12
Page 12

Top view of right exhaust system. Flanges are shown with stud hole rotated clockwise 20 degrees. They should be rotated counter clockwise 20 degrees from spanwise reference.

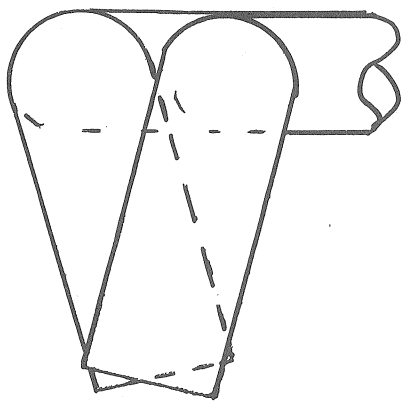
SHOULD BE LIKE THIS

SHOULD NOT BE THIS



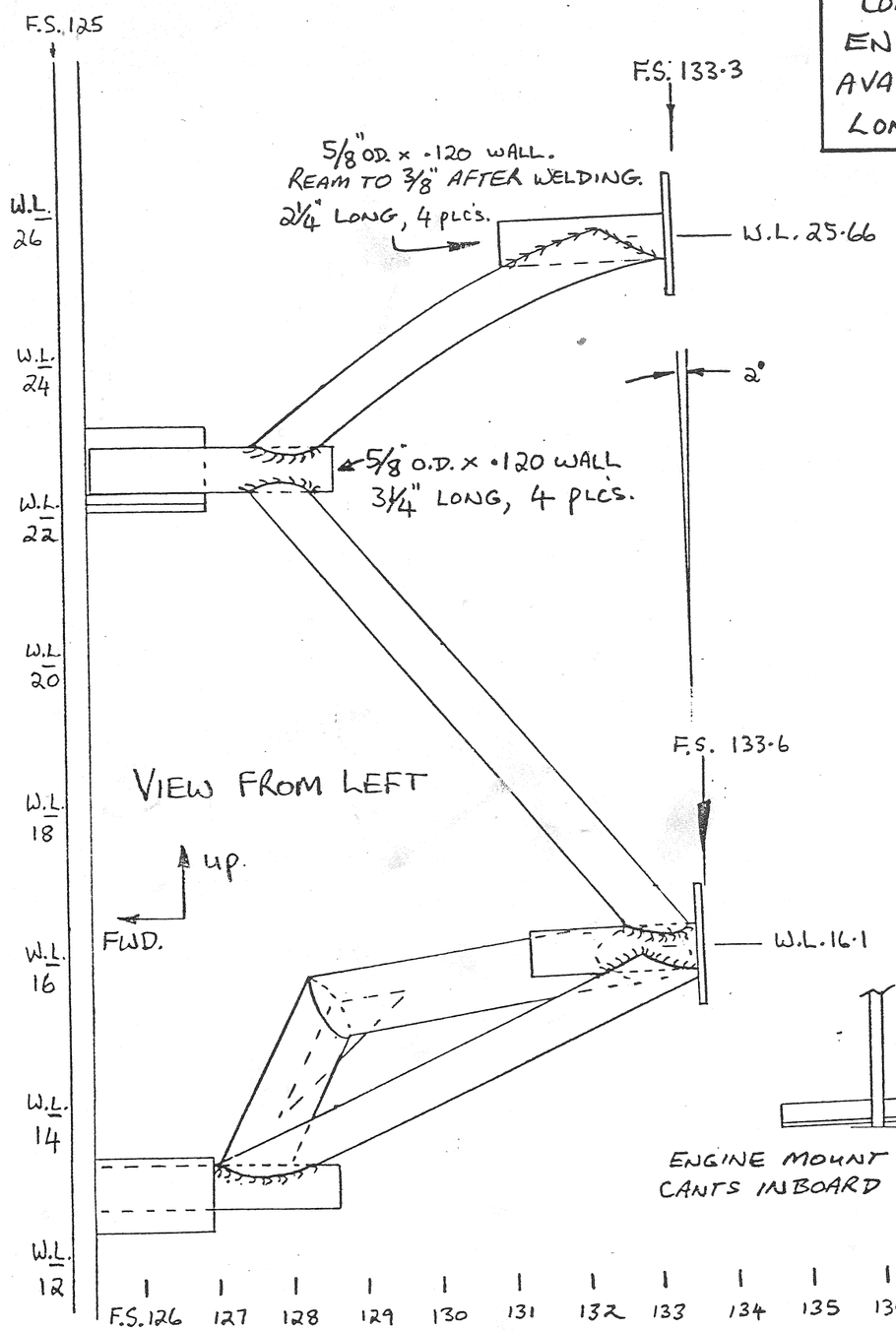
THESE ARE AVAILABLE FROM A DISTRIBUTOR OR MAKE YOUR OWN.

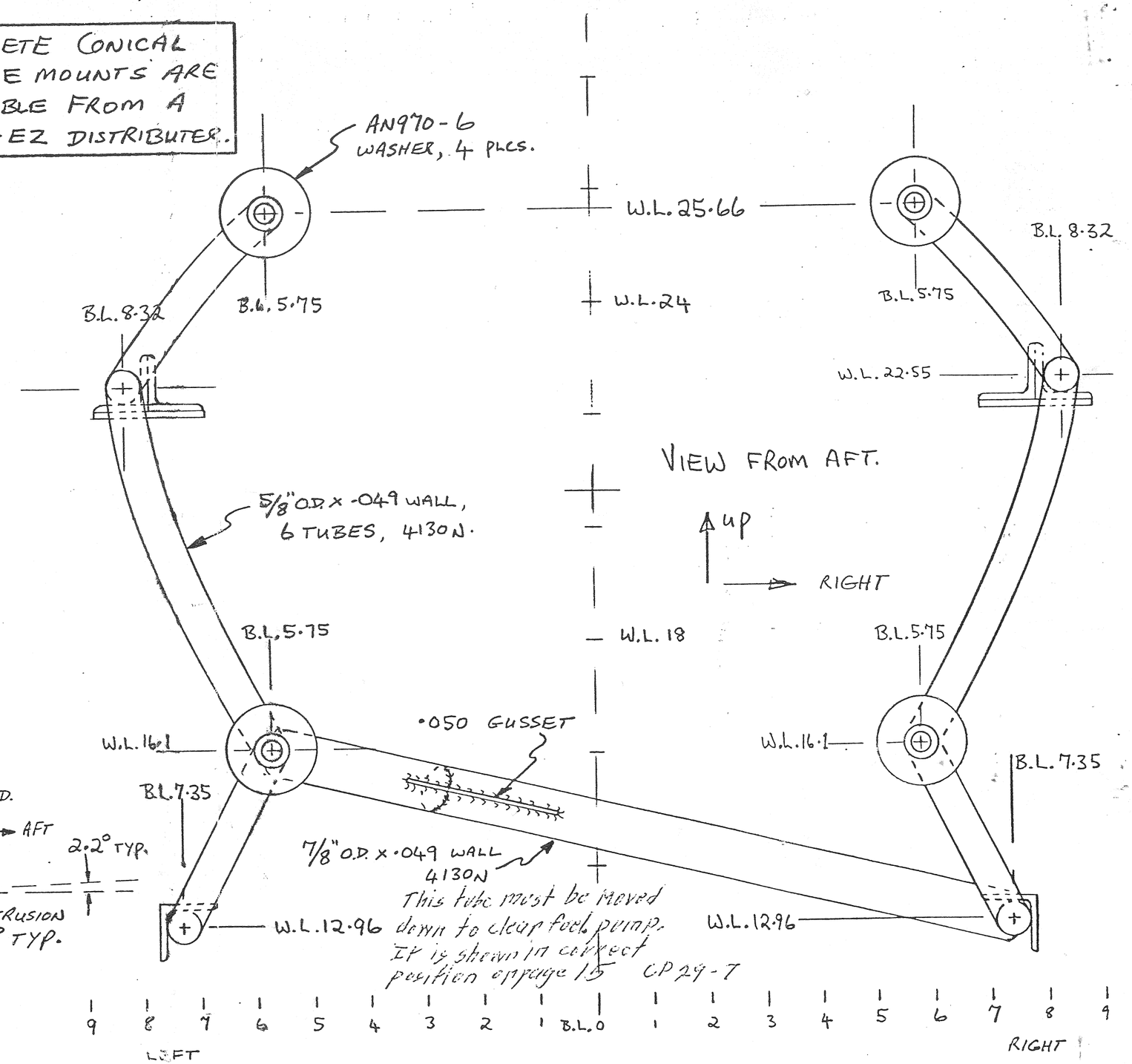
EXHAUST FLANGE
.25 THICK LOW CARBON STEEL
FULL SIZE



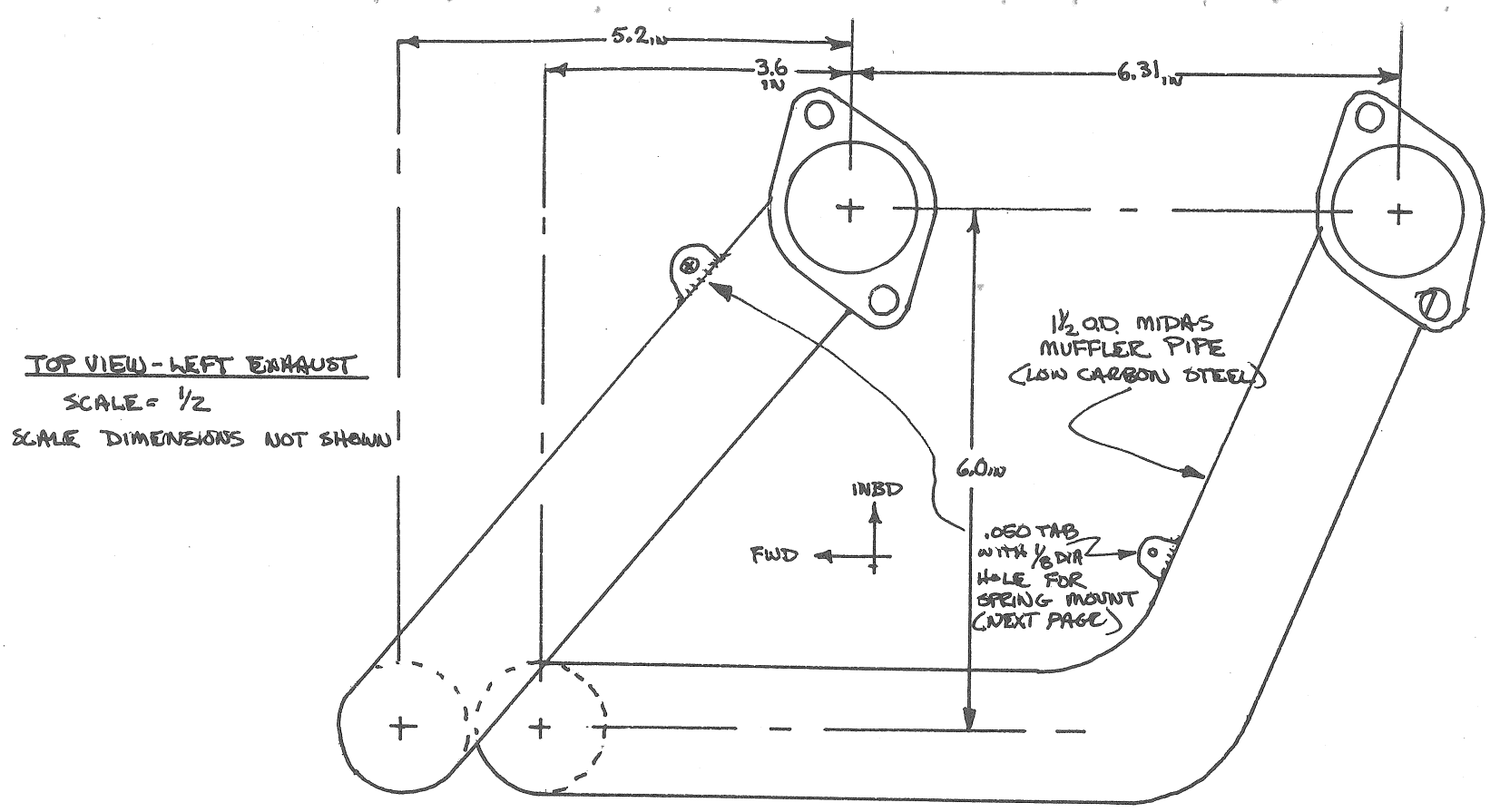
VIEW A-A

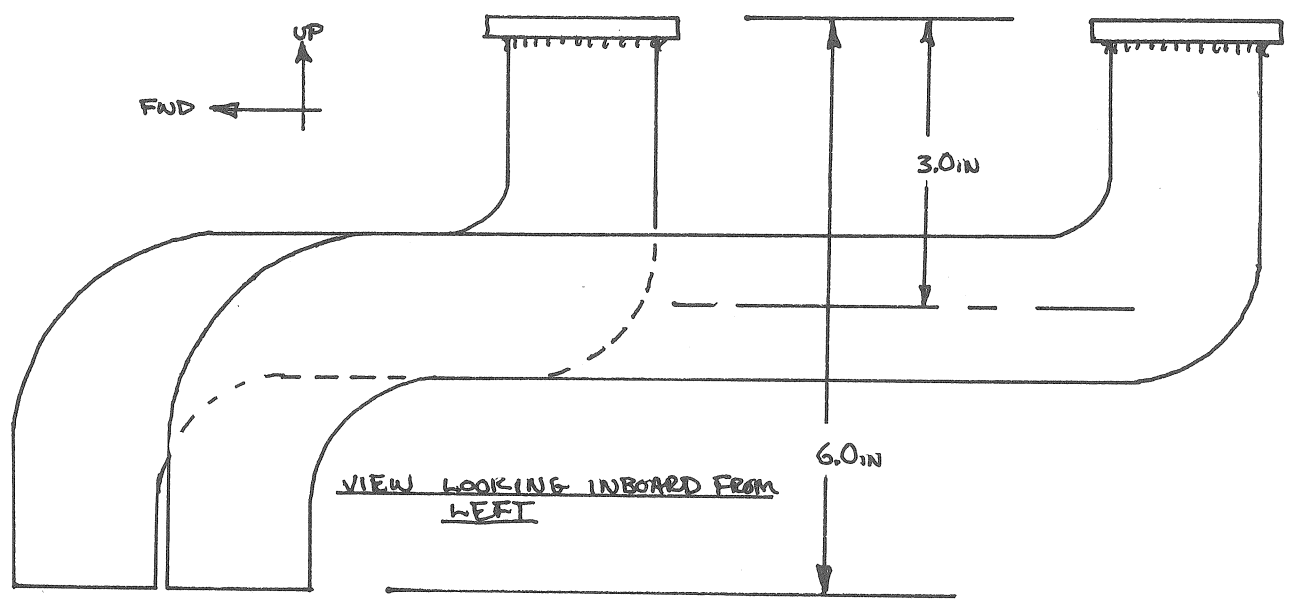
COMPLETE CONICAL ENGINE MOUNTS ARE AVAILABLE FROM A LONG-EZ DISTRIBUTER.





II L P914



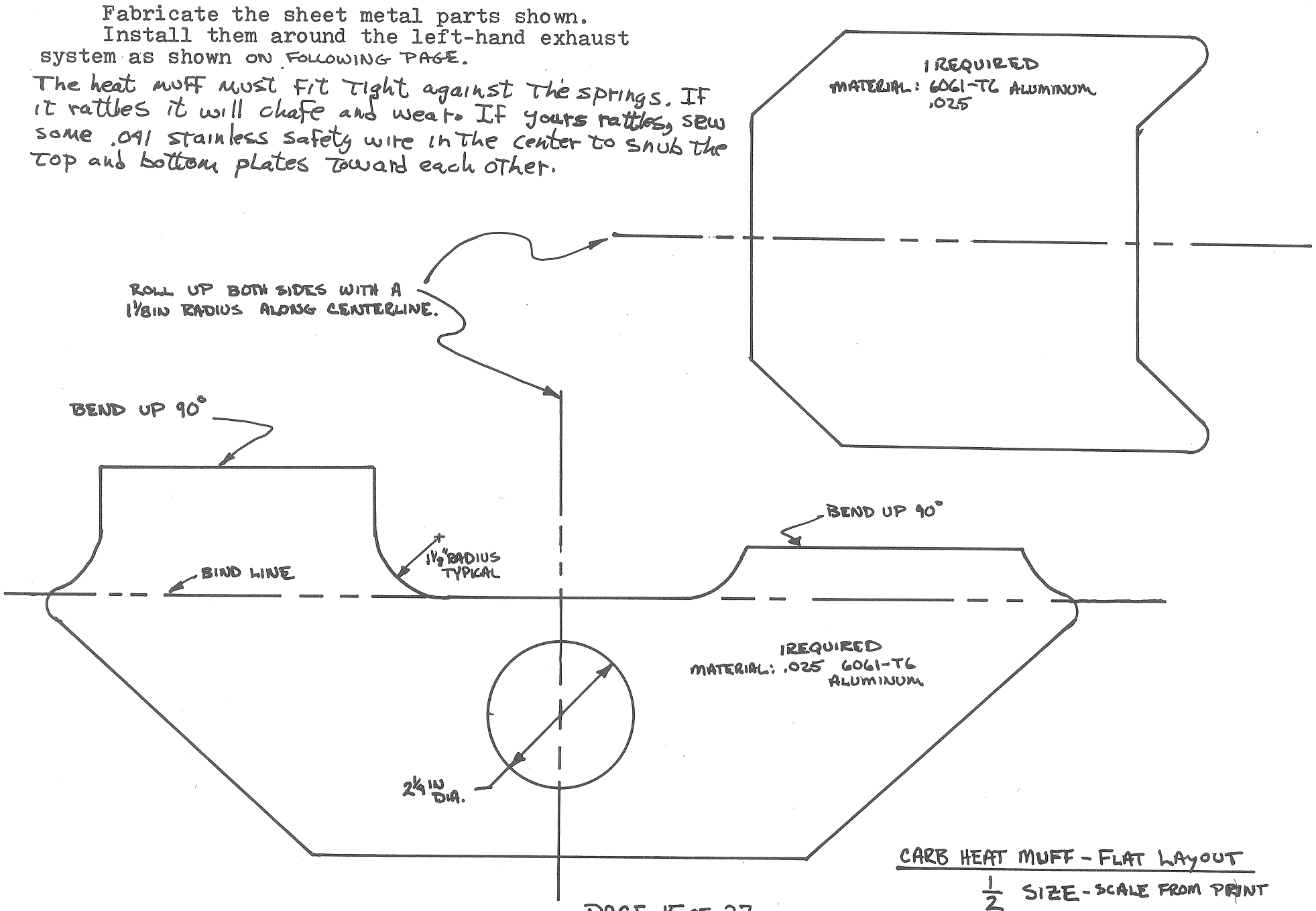


Step 11

Carburetor and Cabin Heat Systems

Fabricate the sheet metal parts shown.
Install them around the left-hand exhaust system as shown ON FOLLOWING PAGE.

The heat muff must fit tight against the springs. If it rattles it will chafe and wear. If yours rattles, sew some .041 stainless safety wire in the center to snub the top and bottom plates toward each other.

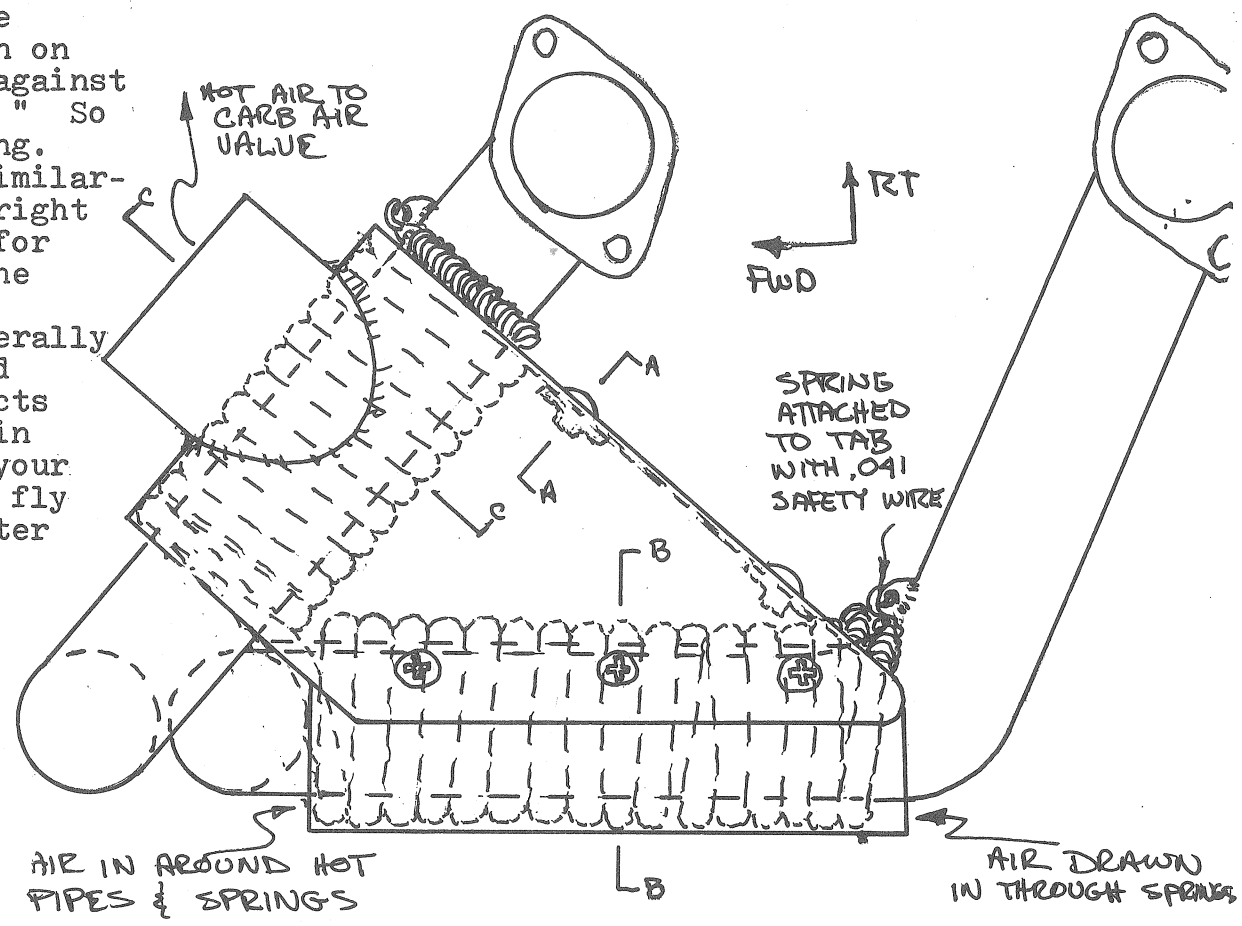


CARB HEAT MUFF - FLAT LAYOUT
½ SIZE - SCALE FROM PRINT

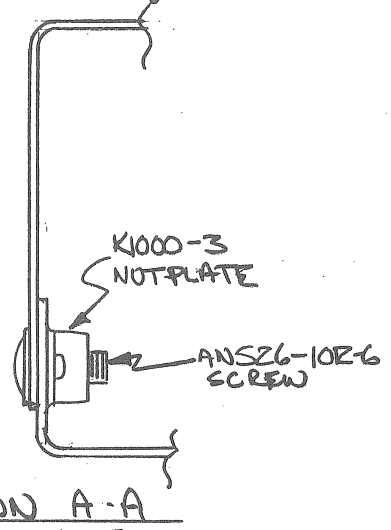
Install a 2-1/2 diameter SCAT-10 (RED) induction hose from the air valve to the muff. Follow the clamping details shown on page 19. This hose should be retained against the engine mount with a nylon "tie wrap" So that it doesn't chafe against the cowling.

For those requiring cabin heat, a similar-type muff and hose can be added to the right side exhaust system. A nice air valve for a cabin heating system is detailed in the April '76 issue of "Sport Aviation."

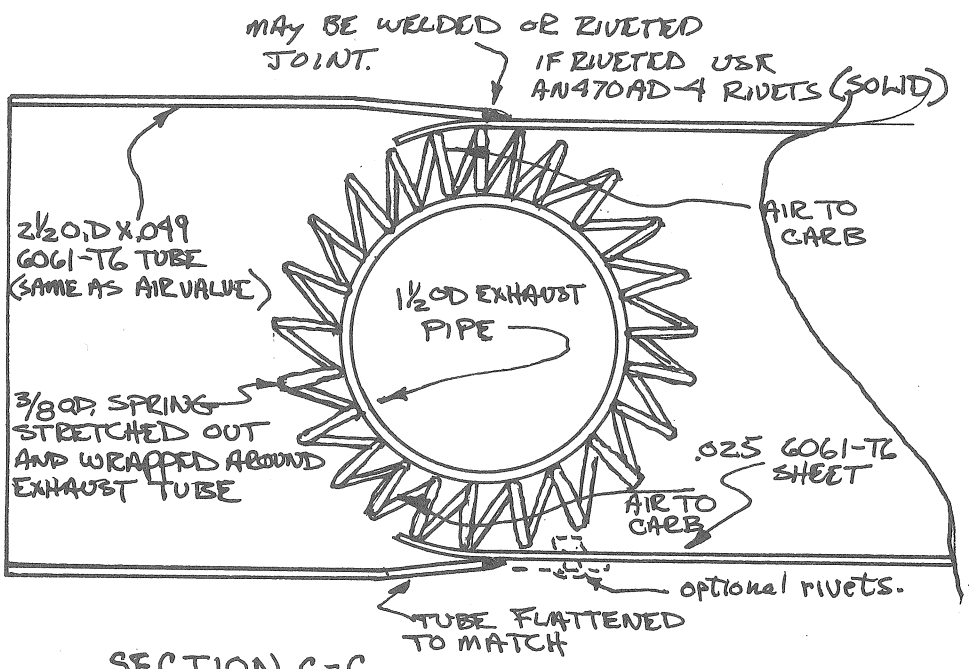
For day-VFR flying the VariEze generally doesn't require cabin heat, even in cold climates, because of "green house" effects and superior cabin insulation. The cabin heater is easily added later following your initial flights. We recommend that you fly your airplane first and add a cabin heater later if you think you need it.



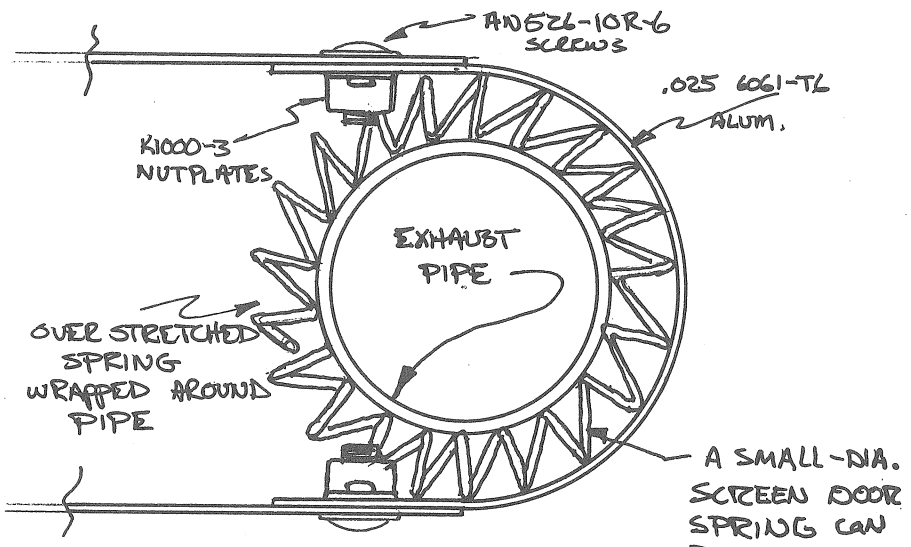
TOP VIEW - CARB HEAT MUFF INSTALLATION
1/2 SCALE



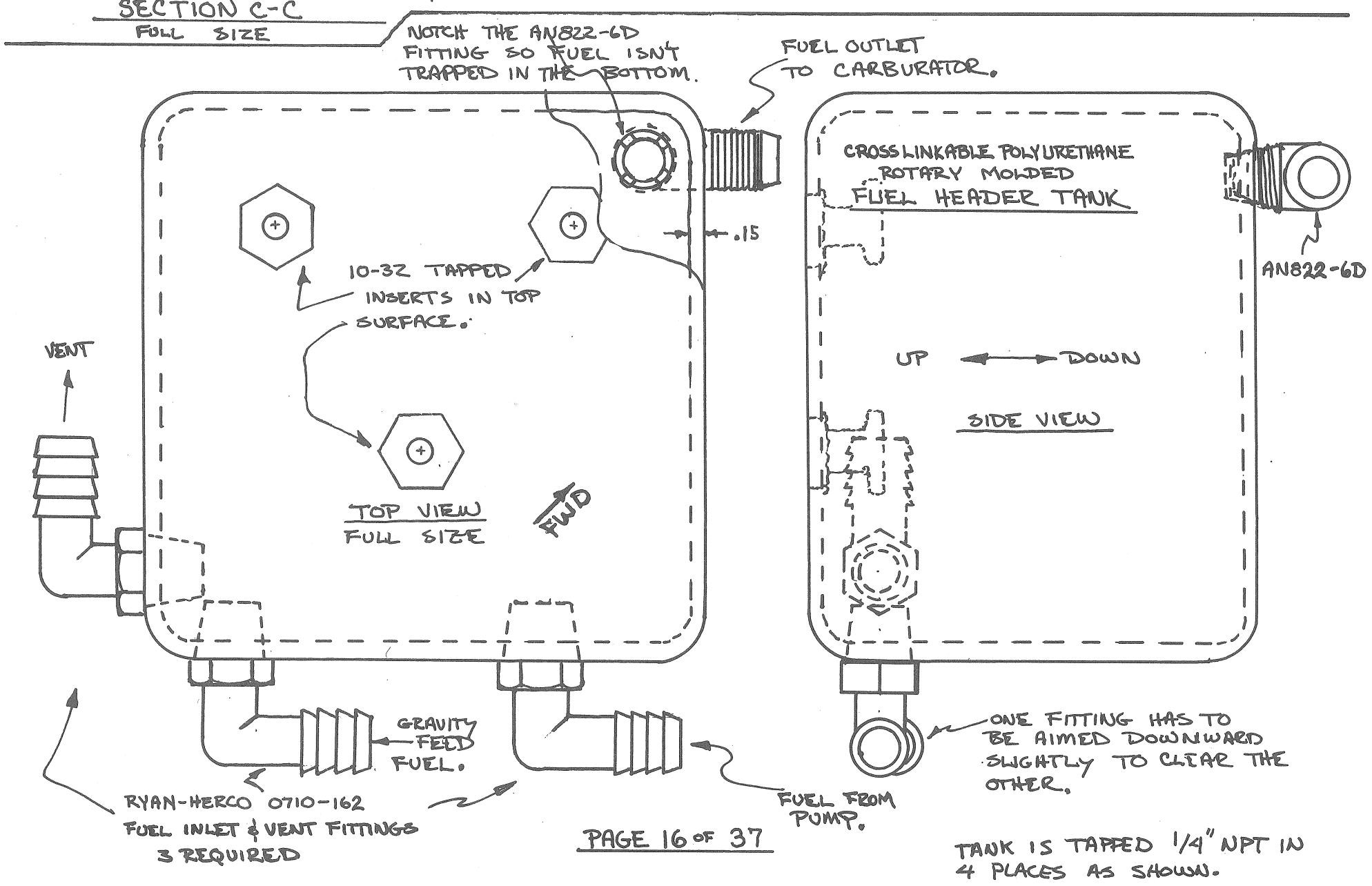
SECTION A-A
FULL SIZE

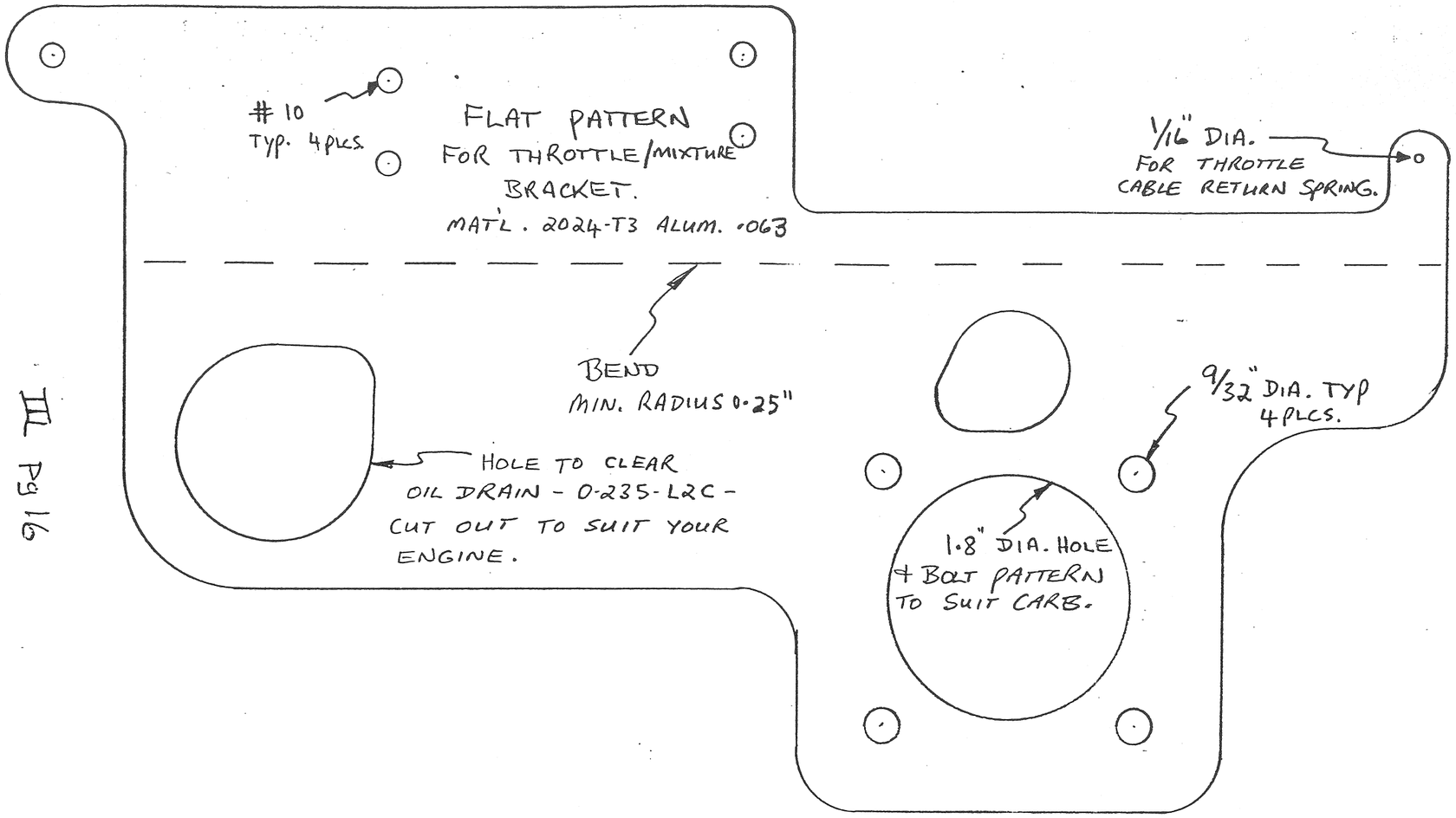


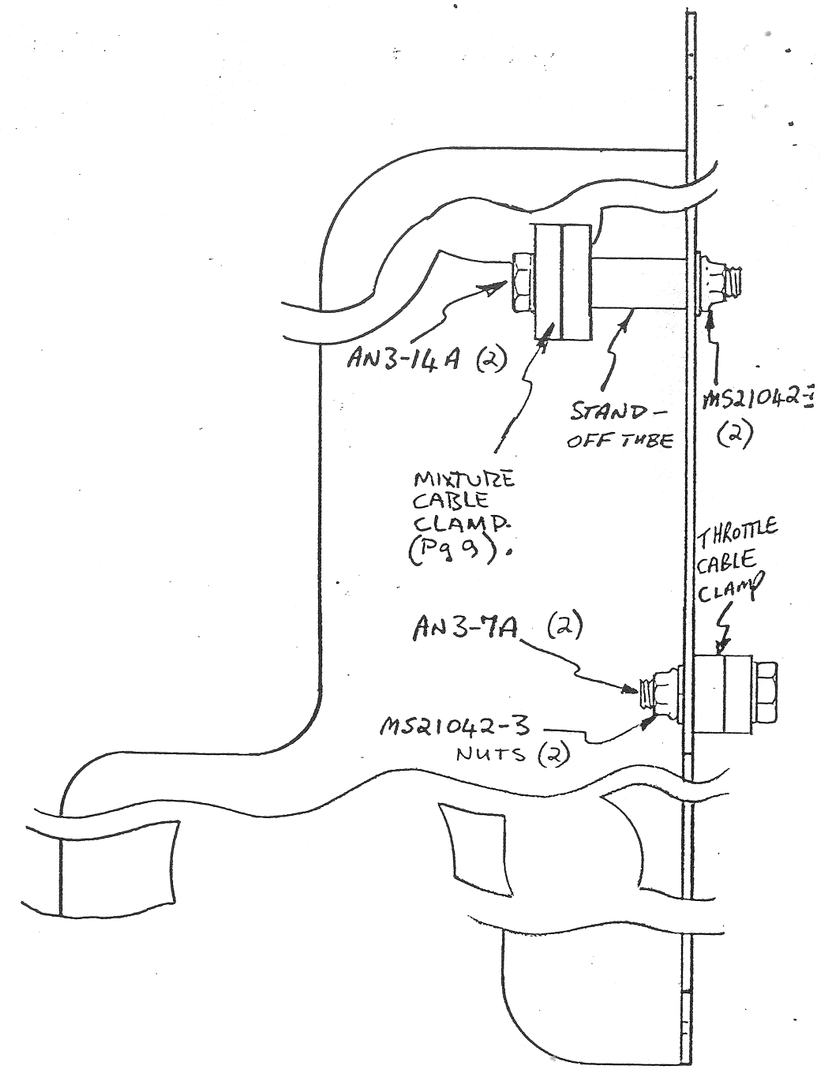
SECTION C-C
FULL SIZE

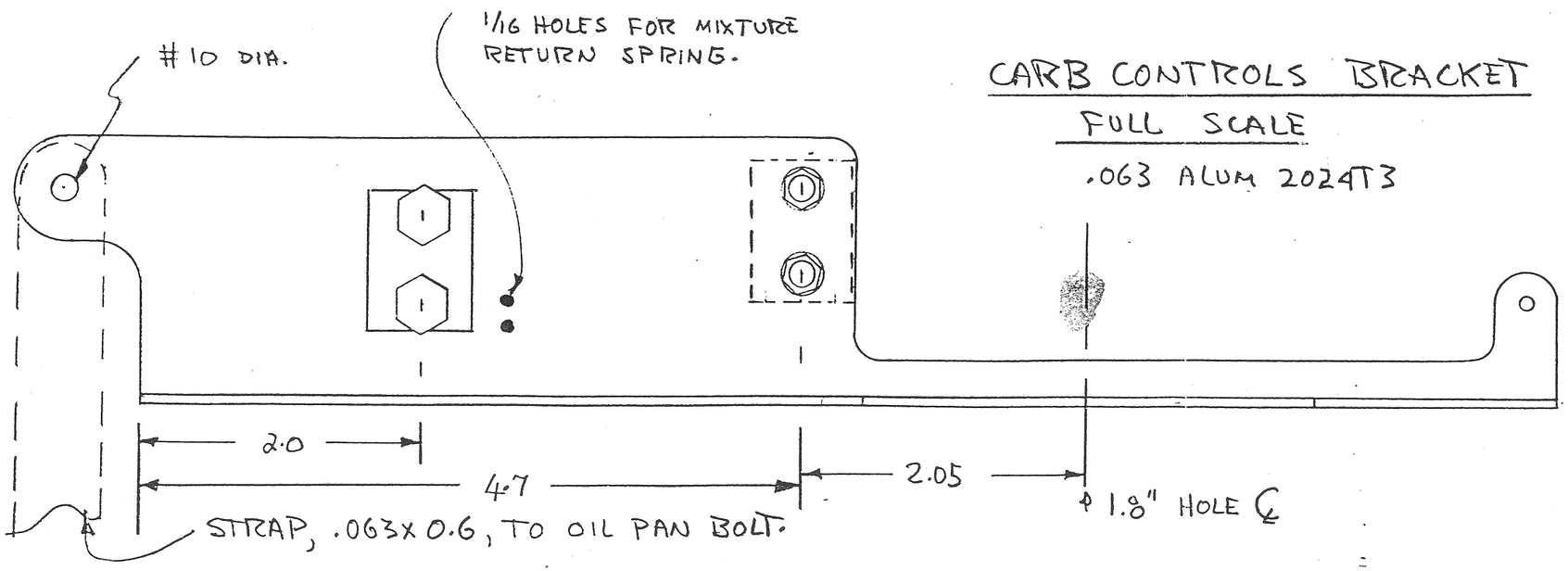


SECTION B-B
FULL SIZE





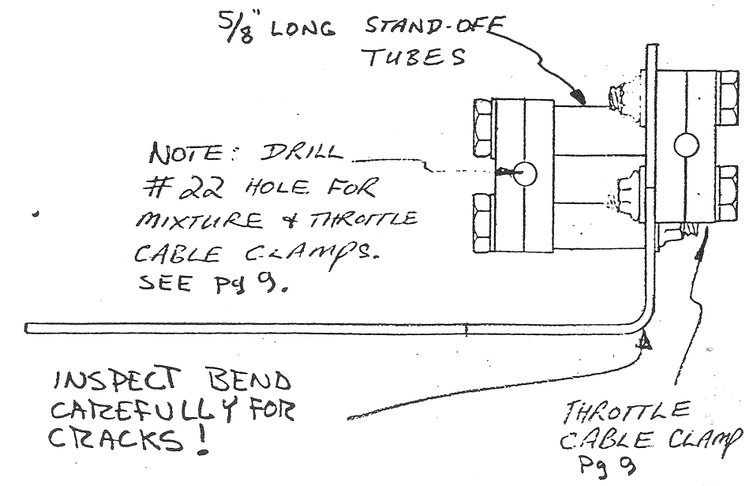




CARB CONTROLS BRACKET

FULL SCALE

.063 ALUM 2024T3

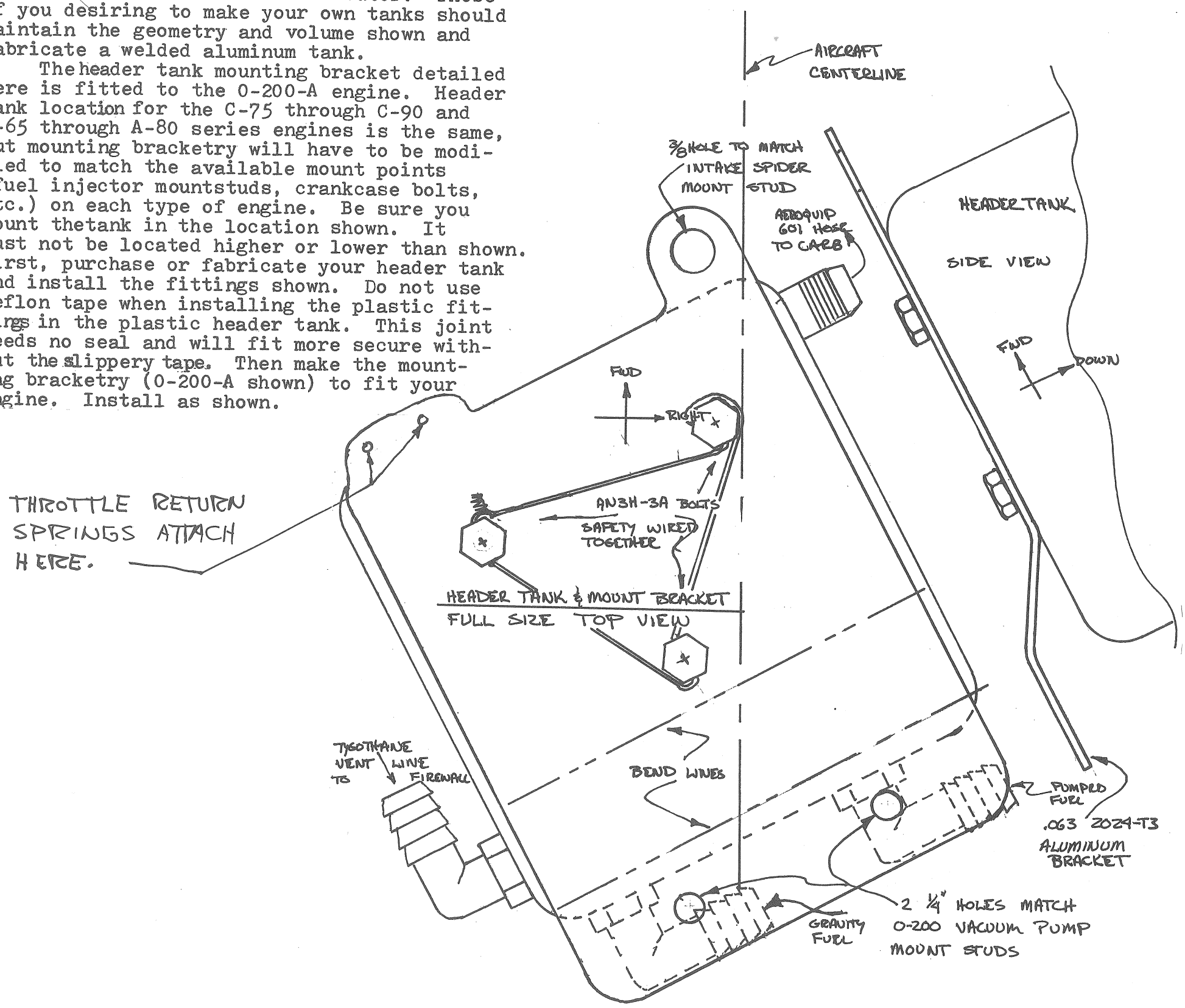


Step 12

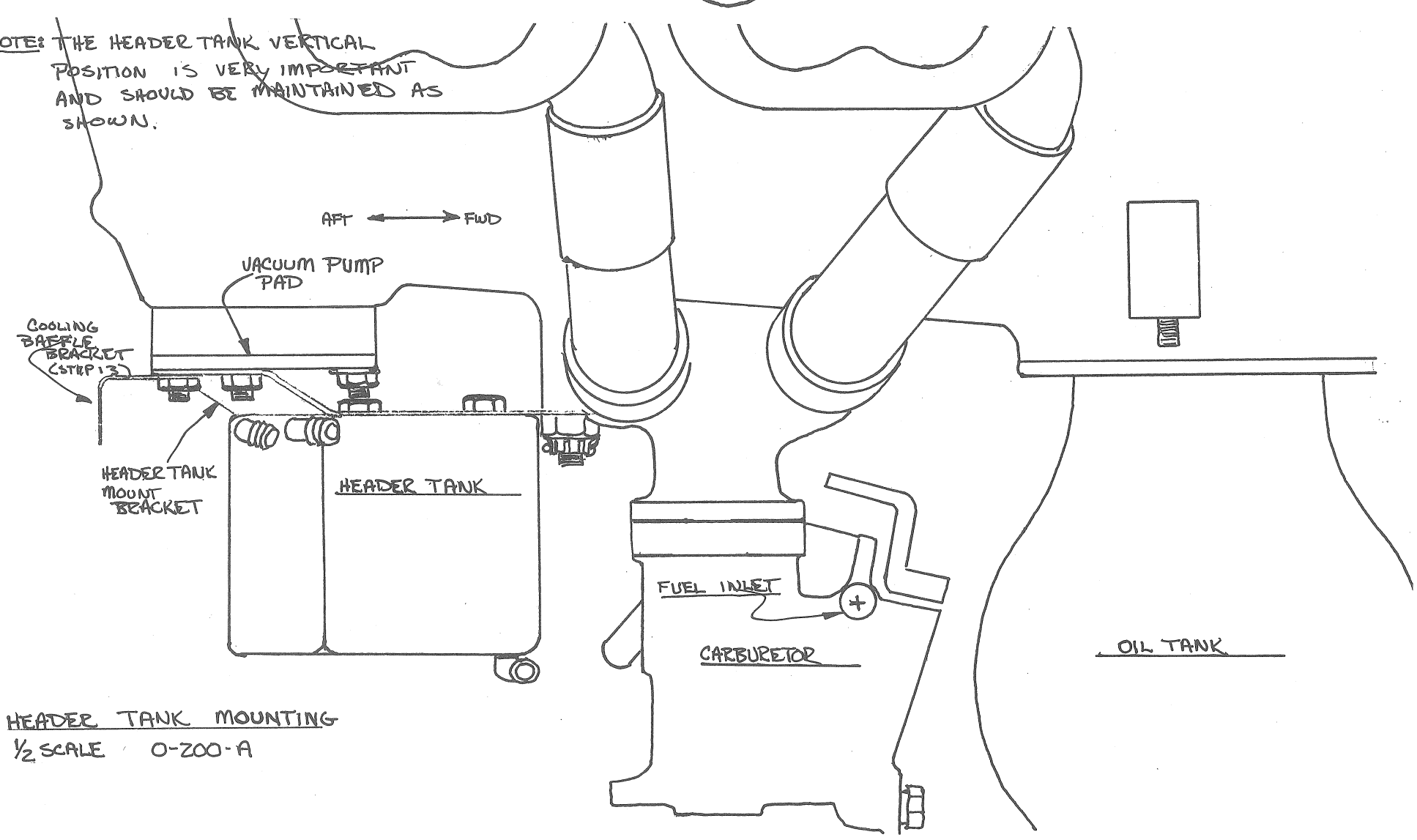
Fuel Header Tank Installation

A rotationally moulded header tank complete with mounting bosses (as shown) is available from a VariEze distributor. Those of you desiring to make your own tanks should maintain the geometry and volume shown and fabricate a welded aluminum tank.

The header tank mounting bracket detailed here is fitted to the 0-200-A engine. Header tank location for the C-75 through C-90 and A-65 through A-80 series engines is the same, but mounting bracketry will have to be modified to match the available mount points (fuel injector mountstuds, crankcase bolts, etc.) on each type of engine. Be sure you mount thetank in the location shown. It must not be located higher or lower than shown. First, purchase or fabricate your header tank and install the fittings shown. Do not use teflon tape when installing the plastic fittings in the plastic header tank. This joint needs no seal and will fit more secure without the slippery tape. Then make the mounting bracketry (0-200-A shown) to fit your engine. Install as shown.



NOTE: THE HEADER TANK VERTICAL POSITION IS VERY IMPORTANT AND SHOULD BE MAINTAINED AS SHOWN.



HEADER TANK MOUNTING
1/2 SCALE 0-200-A

With the header tank installed, cut lengths of tygothane, 3/8 IDx 5/8 OD tube to run from the valve block on the firewall to the header tank inlet and from the fuel boost pump tothe other header tank fuel inlet fitting. Secure the fuel lines against the AIR INTAKE HOSE with a nylon tie wrap, these are to keep the fuel lines from moving around. Don't tie them so tight that the fuel flow is restricted. The fuel inlet lines must run up hill continuously from the valve block to the header tank as shown in the fuel system schematic diagram. Ryan-HERCO TYGOTHANE (3/8 ID x 1/2 OD) tubing is run from the header tank to the vent-system tee high on the firewall (continuously up-hill). The vent line is restrained by nylon tie wrap to the engine and mounting so it doesn't flail around loose inside the cowling. Worm-type hose clamps or safety wire as shown, should be used on all three header tank fittings.

Theconfiguration of the fuel feed line from the header tank to the carburetor will have to be tailored to your individual needs because the different engine types have quite a variation in carburetor fuel inlets. In all cases use aeroquip-type 601-6 armored hose with an aeroquip 816-6D fitting on the header tank end and an aeroquip 8891-6D fitting on the carburetor end. On the carburetor end it is necessary to adapt from the 8891-6D fitting to the carburetor fuel inlet port. For the 0-200-A an AN919-7D reducer is required. Other engine and carburetor types may require different adapter fittings so refer directly to your own engine and service manual for the configuration that you require.

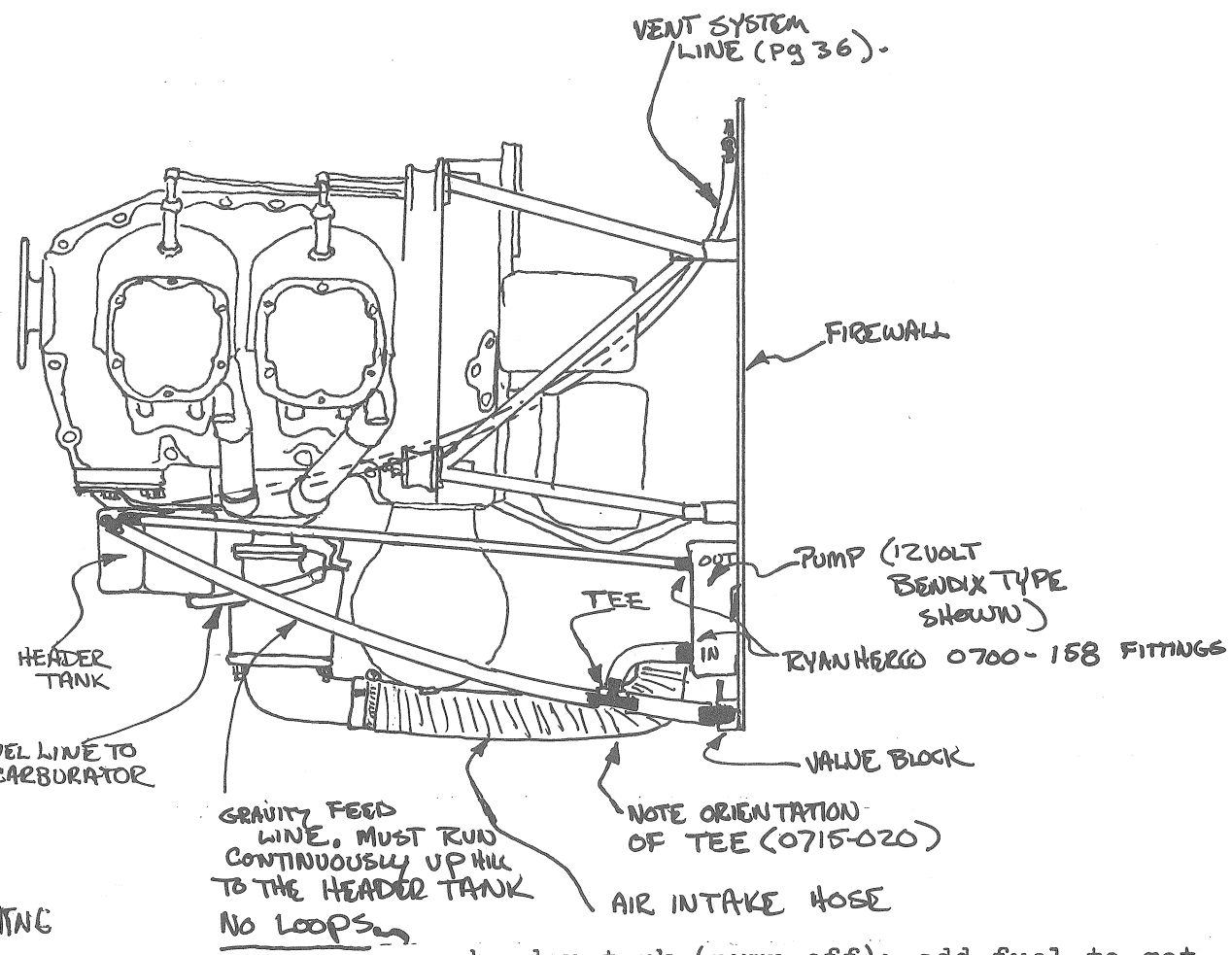
THIS LINE SHOULD have no loops to trap air. Do not use tygothane tubing on the line from the header tank to the carb. It cannot make the required bends without the possibility of a kink.

Now that you have completed the fuel system installation the next step is a fuel system flow check. Note from section I that it is better to install the fuel caps after the airplane has been painted. If you are doing this, you should do the following flushing operations and flow checks after the paint job and cap installation.

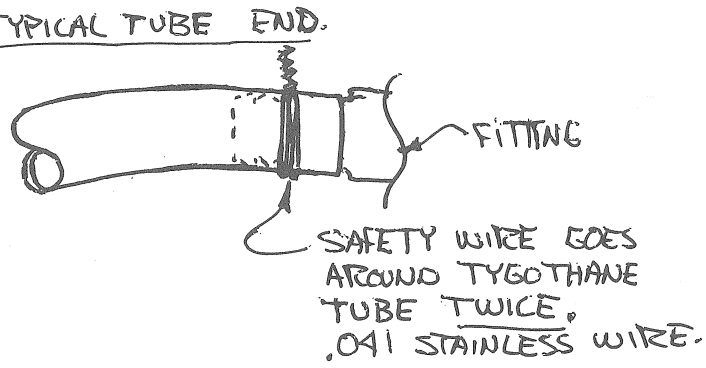
First, disconnect the filters at their inlets; hook a hose on each tank outlet and route it overboard. Pour one gallon of fuel in each tank and raise and lower the nose of the aircraft and rock the wings as you drain the fuel out the outlet. This will flush any obvious contamination possibly left over during fuel cap installation. Reinstall the fuel filters before proceeding. Get a gallon bucket and a stop watch. Disconnect the fuel line at the carburator. Turn the fuel valve off and put two gallons of fuel in each tank. Have your helper hold the airplane level using the W.L. 23 longeron as a reference. Hold your thumb over the end of the fuel line, turn the fuel valve on, and let the header tank fill completely. With the aircraft level, let fuel drain into the bucket for three minutes(180 seconds). The open end of the fuel line must be held at the same level as the carburator fuel inlet during these flow checks. The system should supply ½ gallon or more in this length of time. Dump the fuel after it has been drained; don't put it into the airplane again. Raise the nose 5° and let the fuel drain for two minutes (120 sec). You should get another 1/2-gallon minimum in this time. Now, lower the nose so the airplane is 2° nose low; turn on your boost pump. The boost pump should keep the flow rate at 10 gph as fuel drains into the bucket. Next, lower the nose to the parked position and drain all of the fuel from the header tank (pump off); add fuel to get two gallons in each tank again; raise the nose to level. Fuel flow should start into the bucket within 15 seconds and maintain at least 10 gal-per-hour. Level the airplane and drain all of the fuel remaining. Hook the line back up to the carb. Close the drain and add one gallon of fuel to each tank, mark the level on each gauge in the rear cockpit. Add another gallon to each side, mark and repeat until full capacity is reached. This maneuver calibrates your fuel gauges for level flight and gives you the total usable fuel quantity for your airplane.

The fuel flow readings in a level attitude are conservative, since the airplane cruises with the nose up one to three degrees, depending on speed and weight.

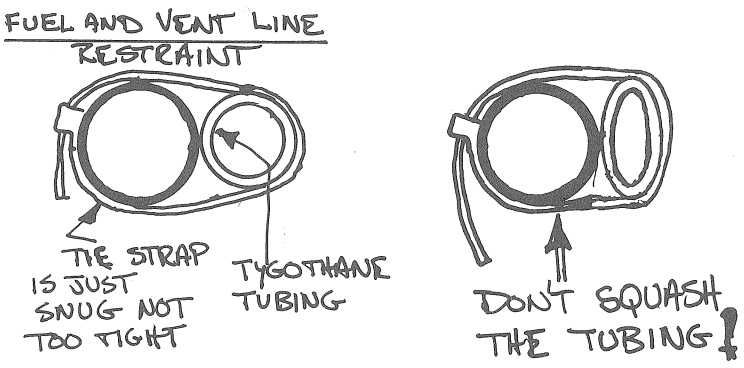
FUEL SYSTEM plumbing



TYPICAL TUBE END.



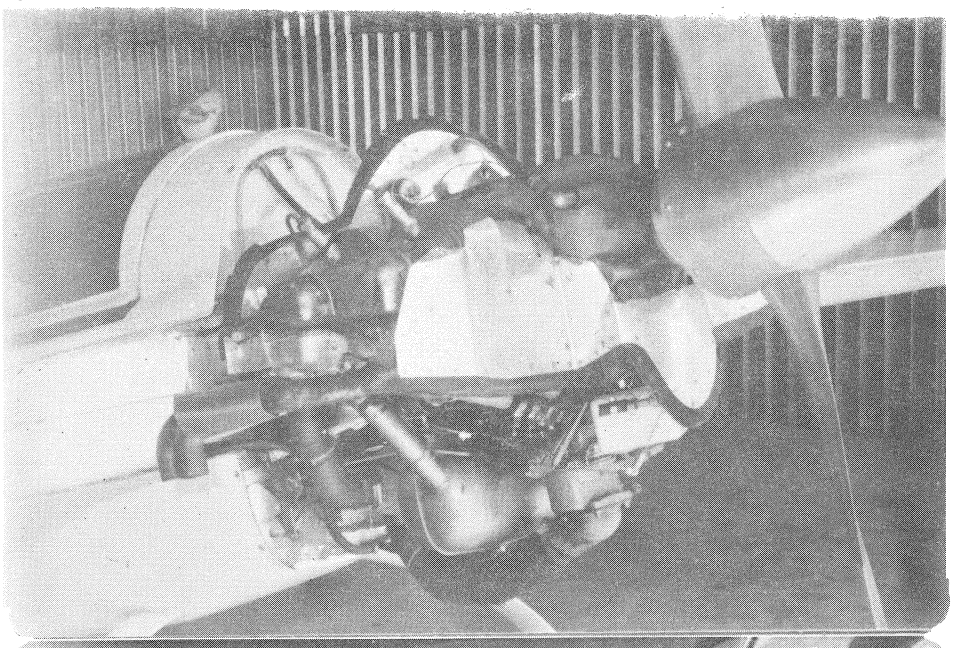
FUEL AND VENT LINE RESTRAINT

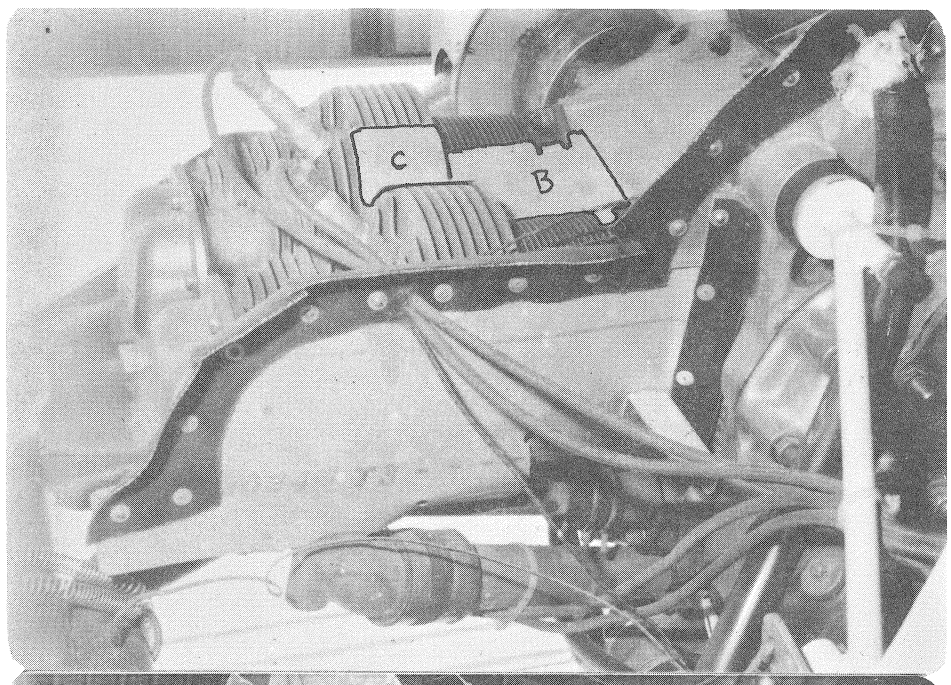


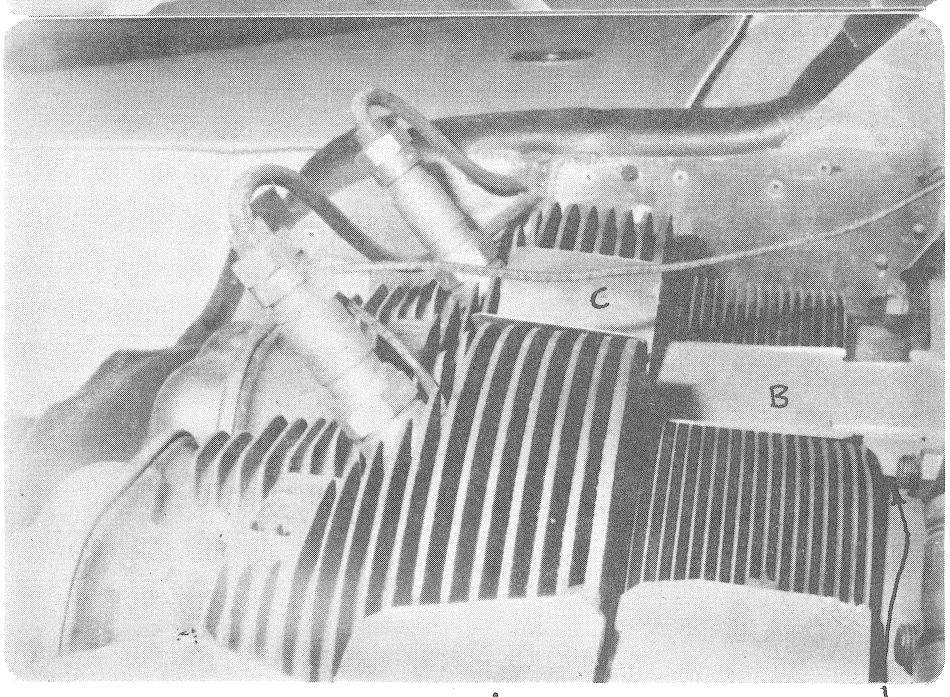
Step 13
Cooling Baffles

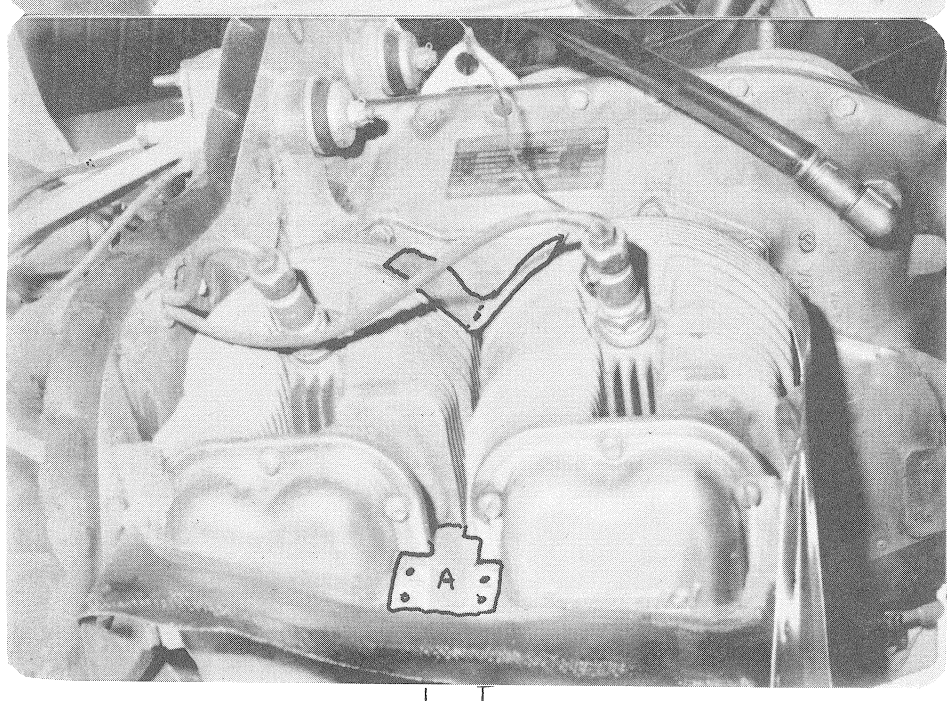
Fabricate the baffling from 6061-T6 aluminum using the flat patterns shown on pages 19 through 26. Install the baffling as shown in the accompanying sketches and photos. Use the silicone rubber to seal imperfect fits and as an anti-chafing material.

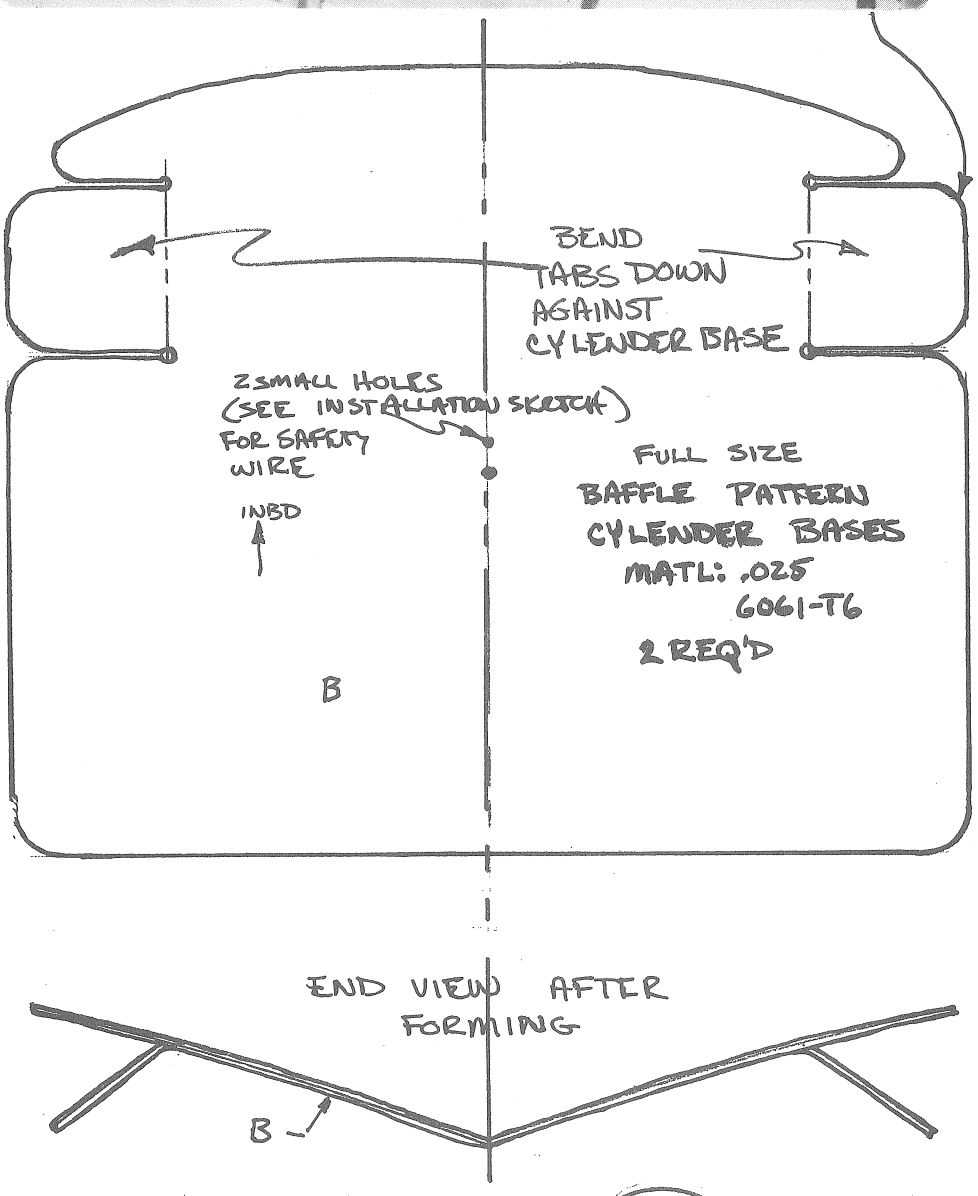
Do not install the rubber seal strips yet. These are fit in after cowling installation to assure a perfect fit to the cowling.

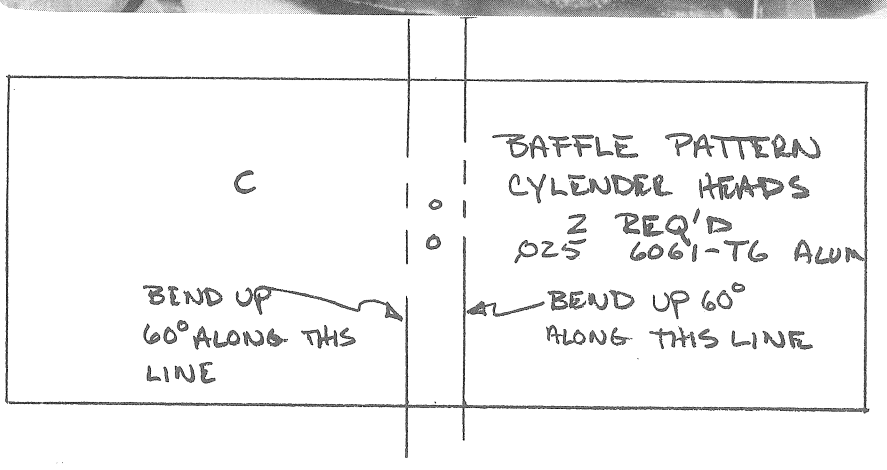


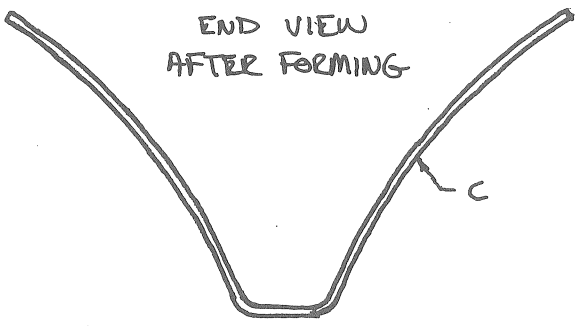


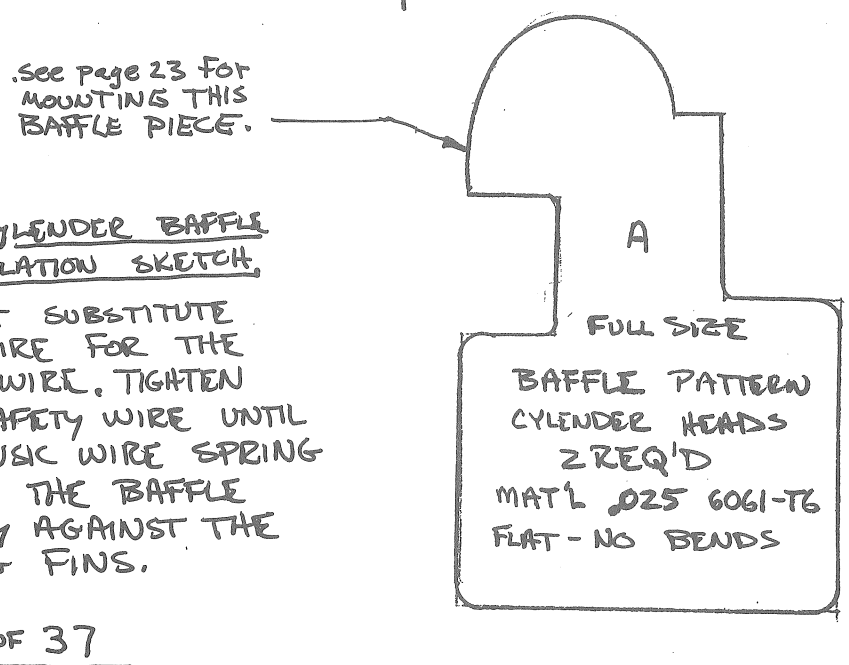


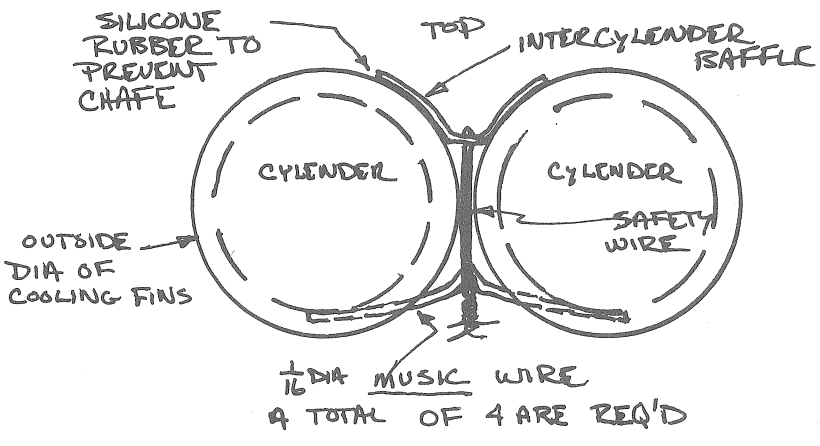






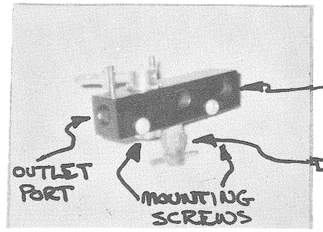




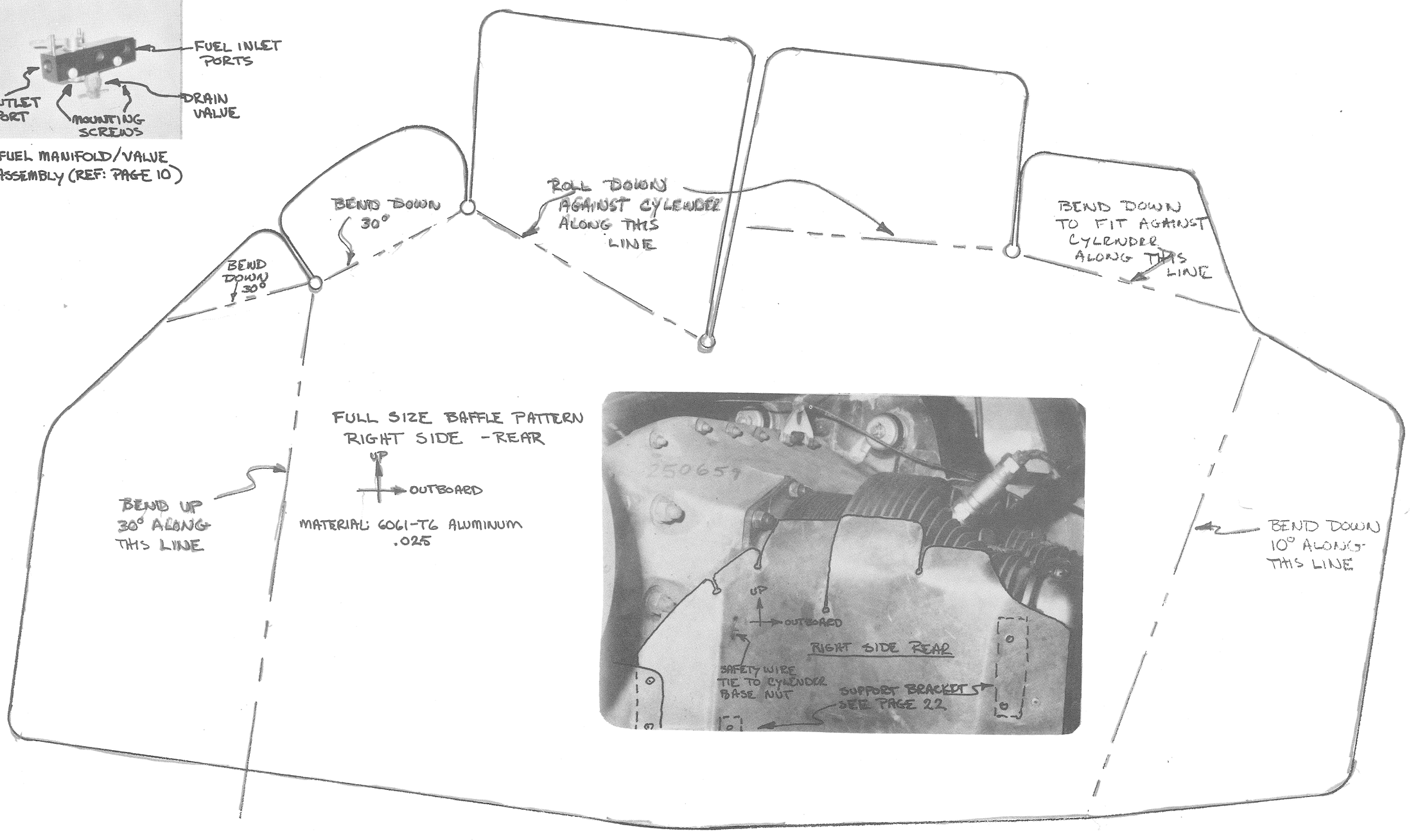


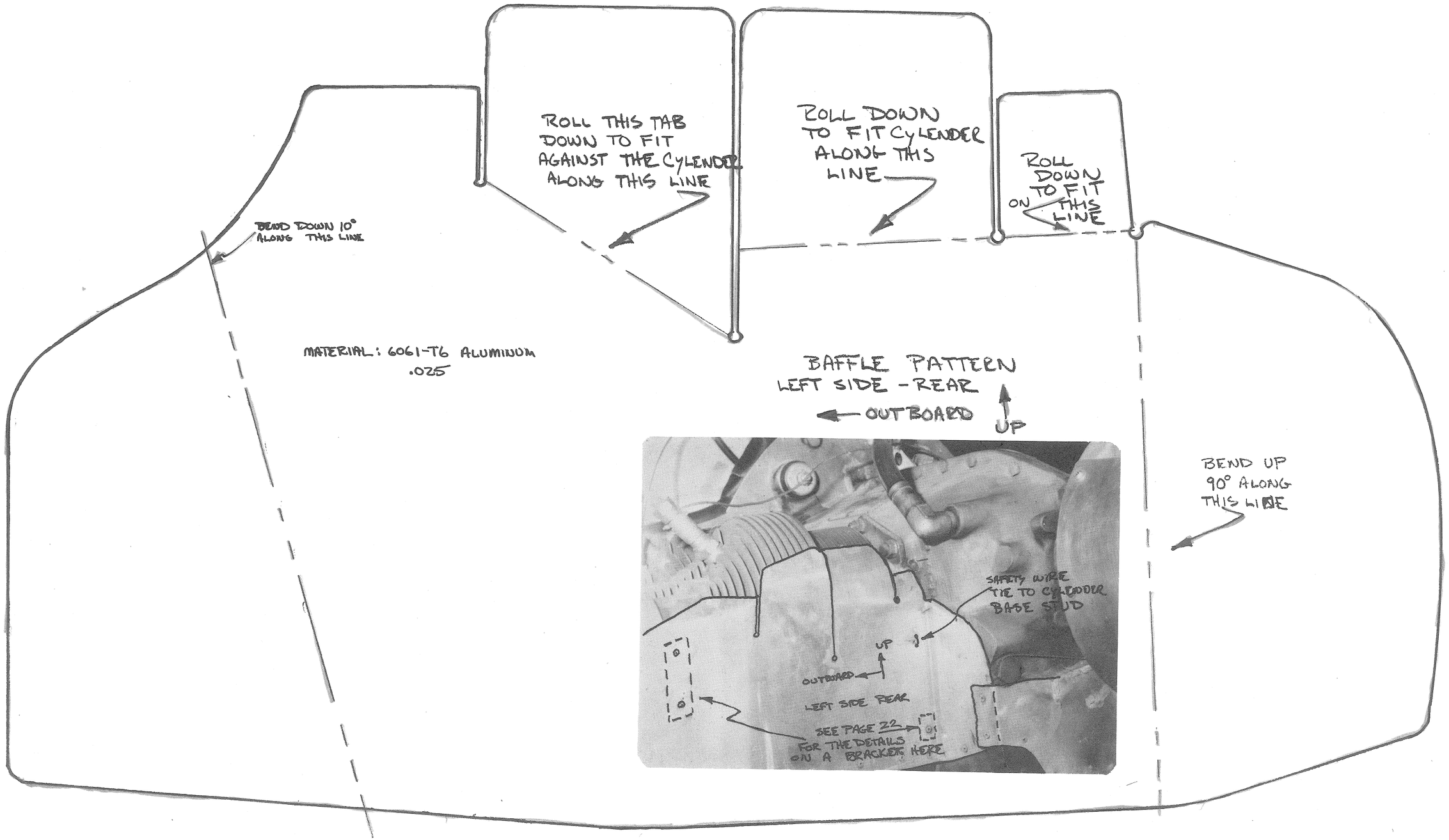
INTER CYLENDER BAFFLE INSTALLATION SKETCH.

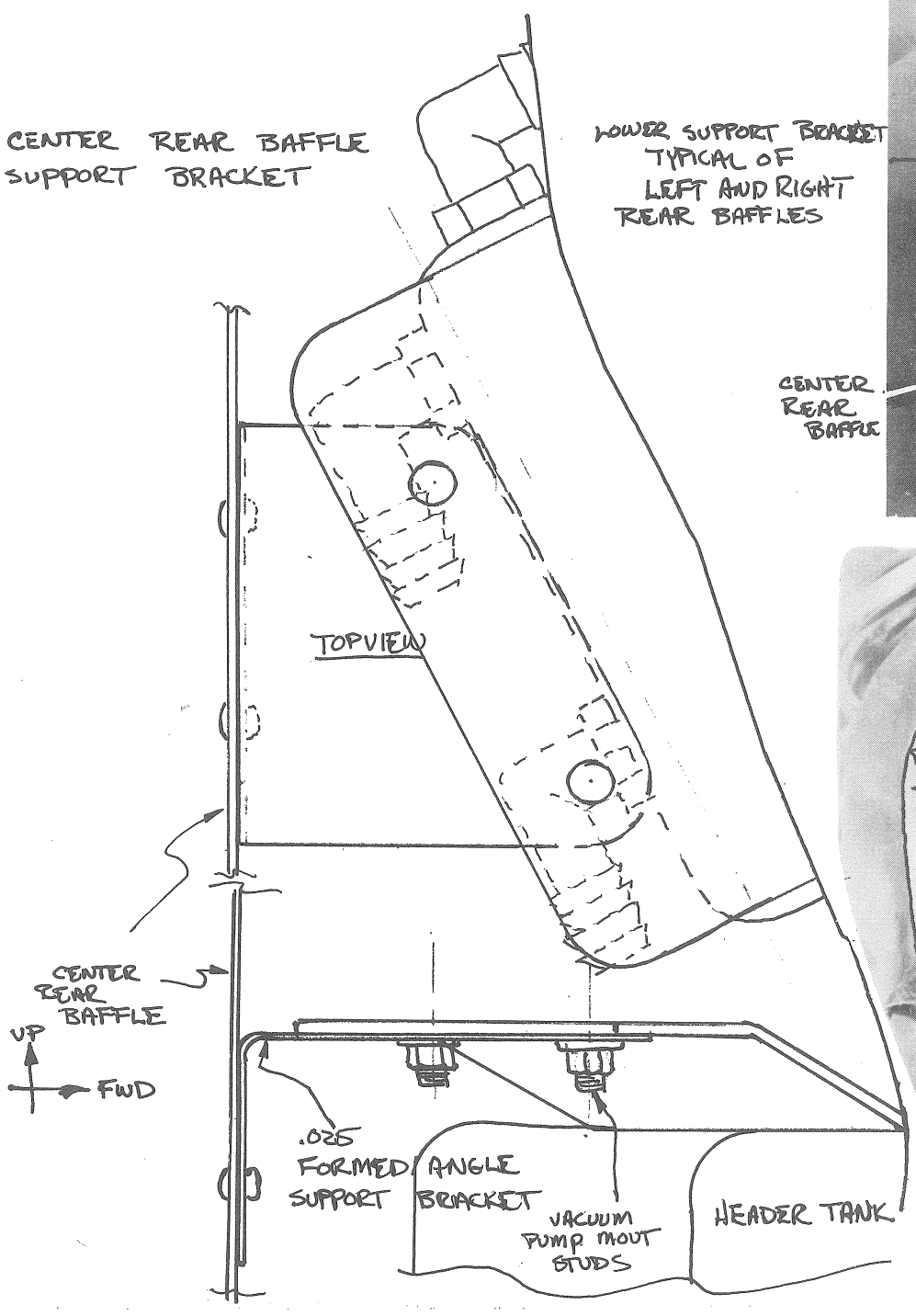
DO NOT SUBSTITUTE SOFT WIRE FOR THE MUSIC WIRE. TIGHTEN THE SAFETY WIRE UNTIL THE MUSIC WIRE SPRING LOADS THE BAFFLE FIRMLY AGAINST THE COOLING FINS.

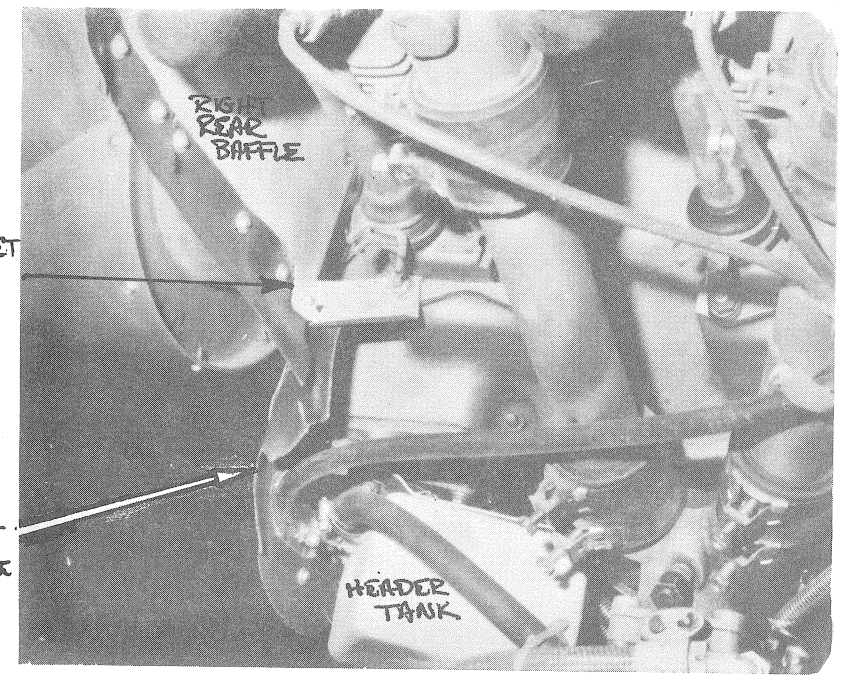


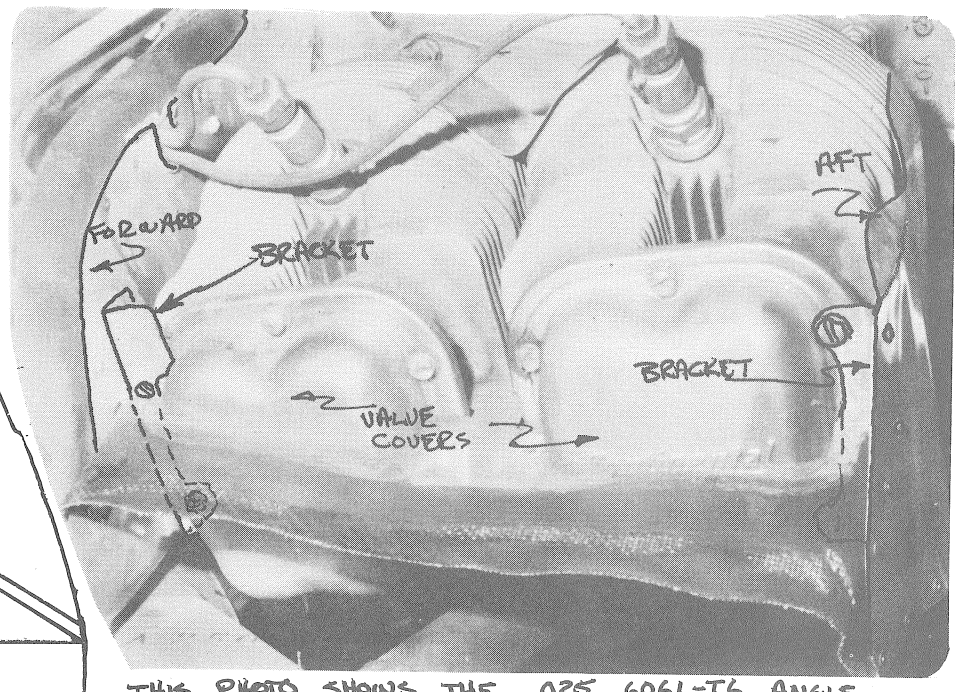
FUEL MANIFOLD/VALVE ASSEMBLY (REF: PAGE 10)




ROLL THIS TAB DOWN TO FIT AGAINST THE CYLENDER ALONG THIS LINE
ROLL DOWN TO FIT CYLENDER ALONG THIS LINE
ROLL DOWN TO FIT ON THIS LINE
BEND DOWN 10° ALONG THIS LINE
MATERIAL: 6061-T6 ALUMINUM .025
BAFFLE PATTERN
LEFT SIDE - REAR
OUTBOARD
UP
BEND UP 90° ALONG THIS LINE
SAFETY WIRE TIE TO CYLENDER BASE STUD
UP
OUTBOARD
LEFT SIDE REAR
SEE PAGE 22 FOR THE DETAILS ON A BRACKET HERE

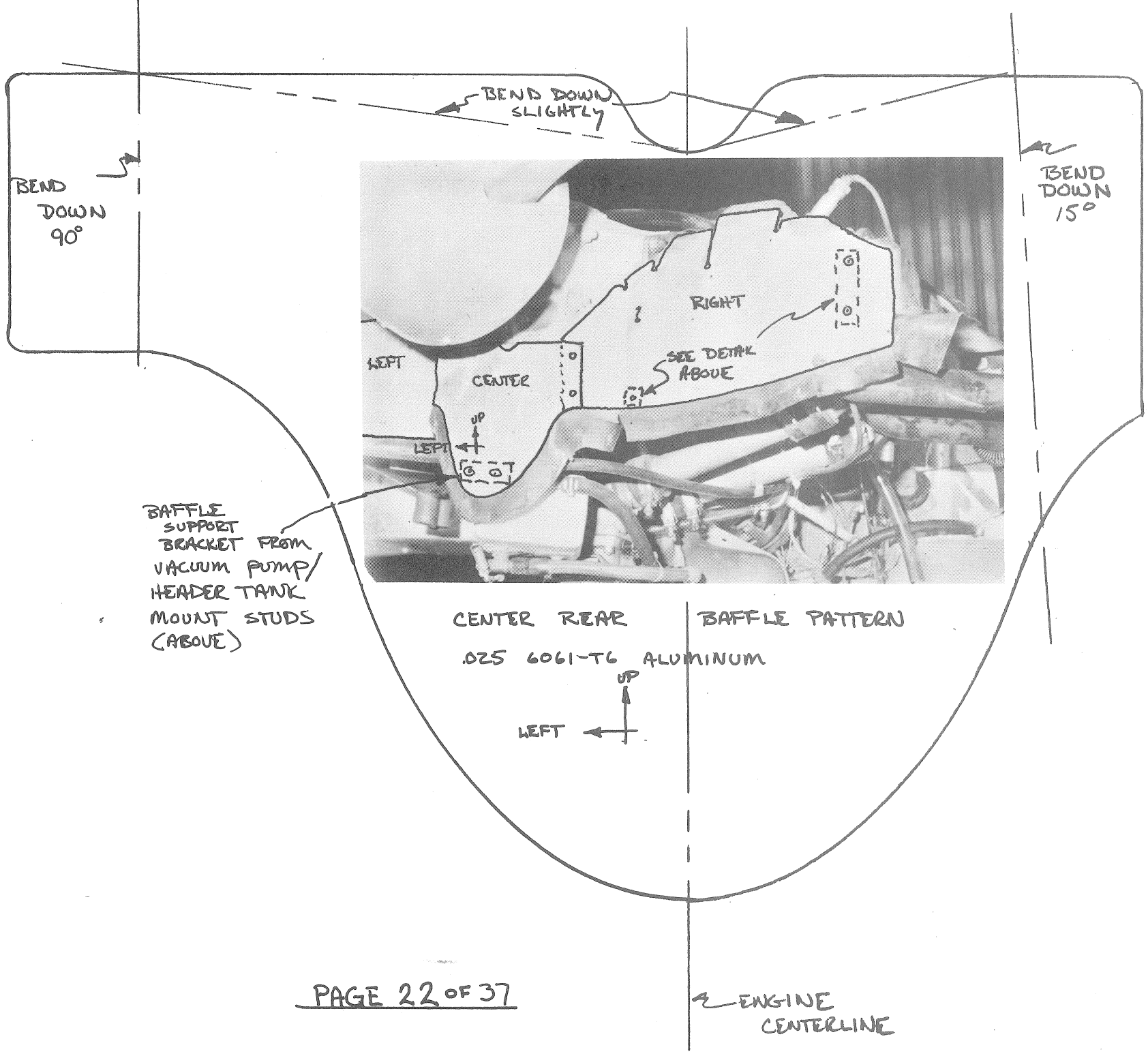


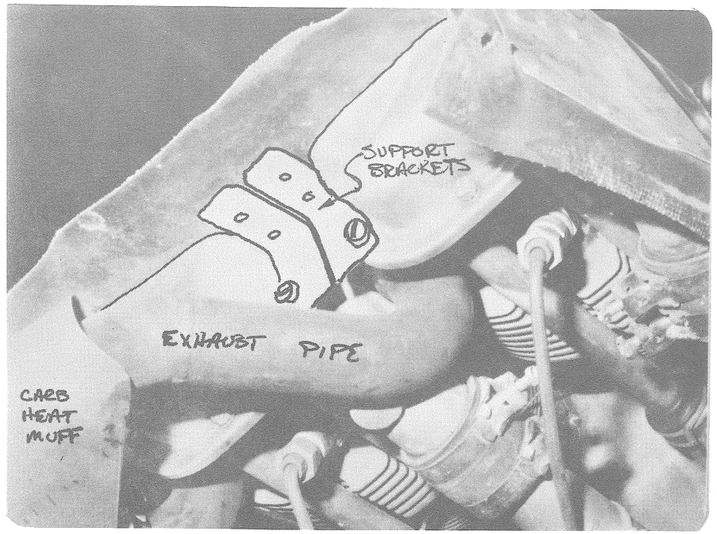




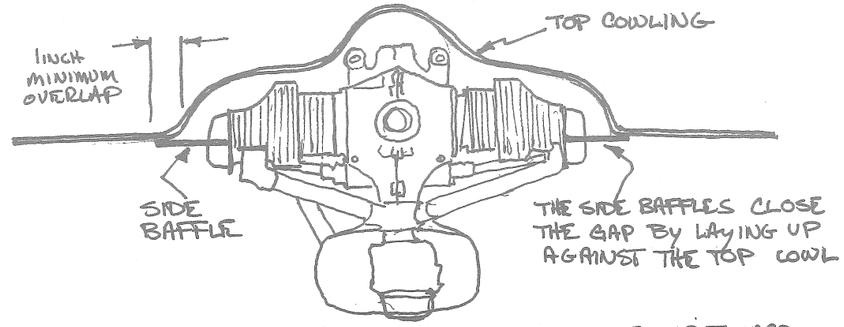
THIS PHOTO SHOWS THE .025 6061-T6 ANGLE BRACKETS WHICH ATTACH THE REAR RIGHT AND LEFT BAFFLES TO THE VALVE COVERS. THE FORWARD BAFFLES ATTACH SIMILARLY. EACH BRACKET PICKS UP 2 VALVE COVER SCREWS AND RIVETS TO THE BAFFLES.

ALL RIVETS ARE AVEX 1601-0910 or Cherry MSP43

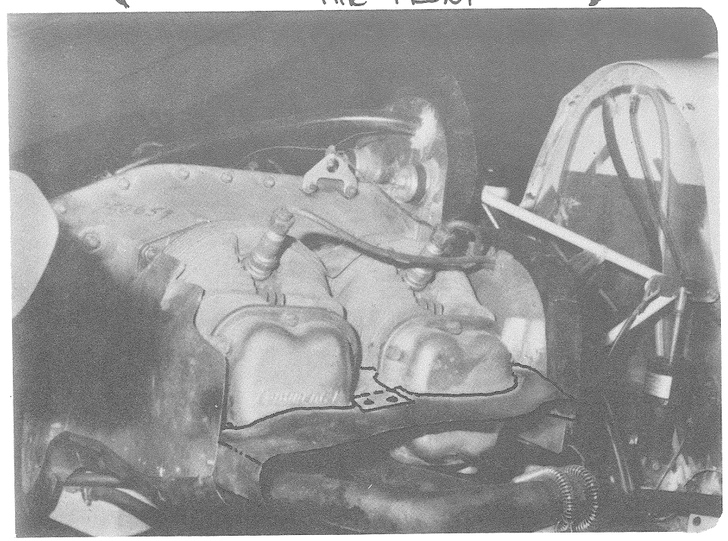


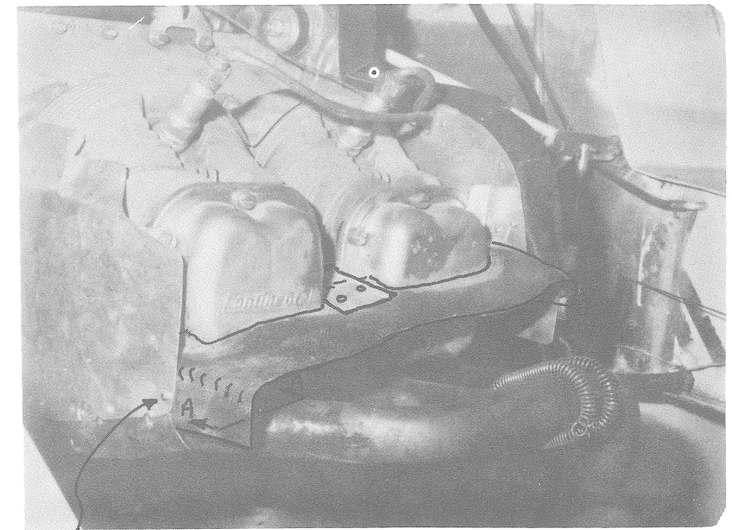


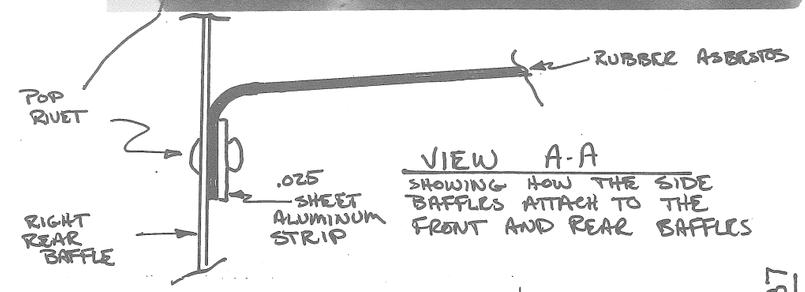
THE SUPPORT BRACKETS ABOVE USE ONE OF THE VALVE COVER SCREWS AS SHOWN AND ARE RIVETED TO THE ODD SHAPED LITTLE INTERCYLENDER BAFFLE SHOWN ON PAGE 19 WITH THE RUBBER ASTBESTOS SIDE BAFFLE SANDWICHED IN BETWEEN.



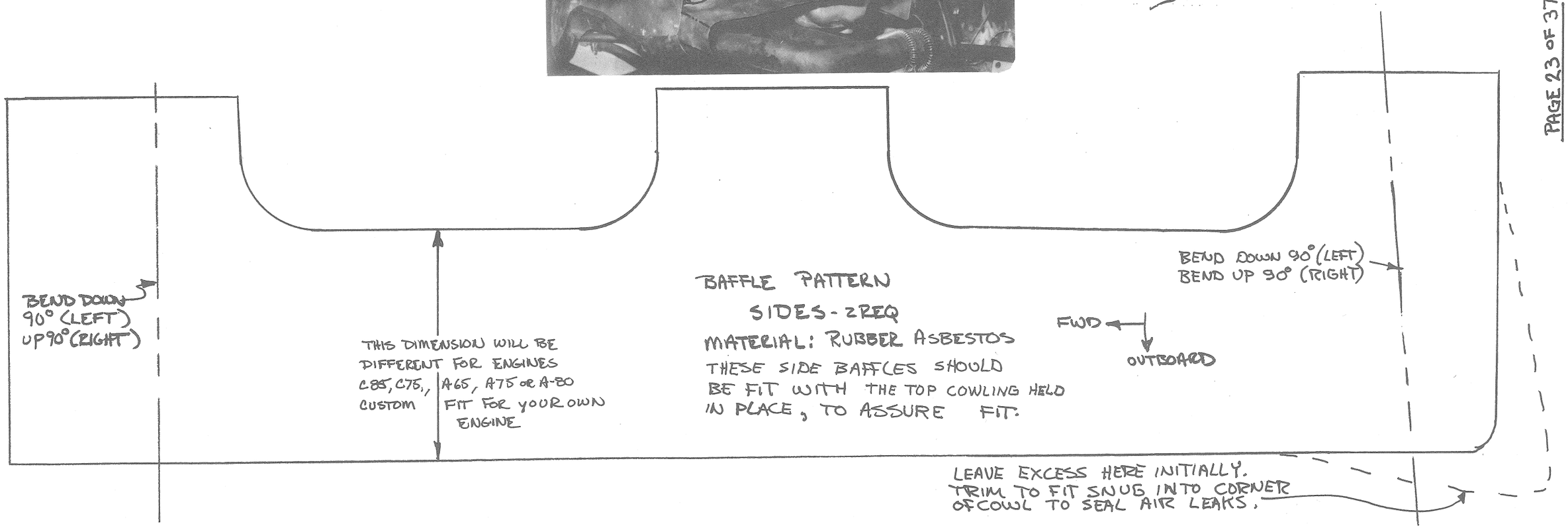
NOTE THAT THE SIDE BAFFLES SLOPE UP TOWARD THE FRONT

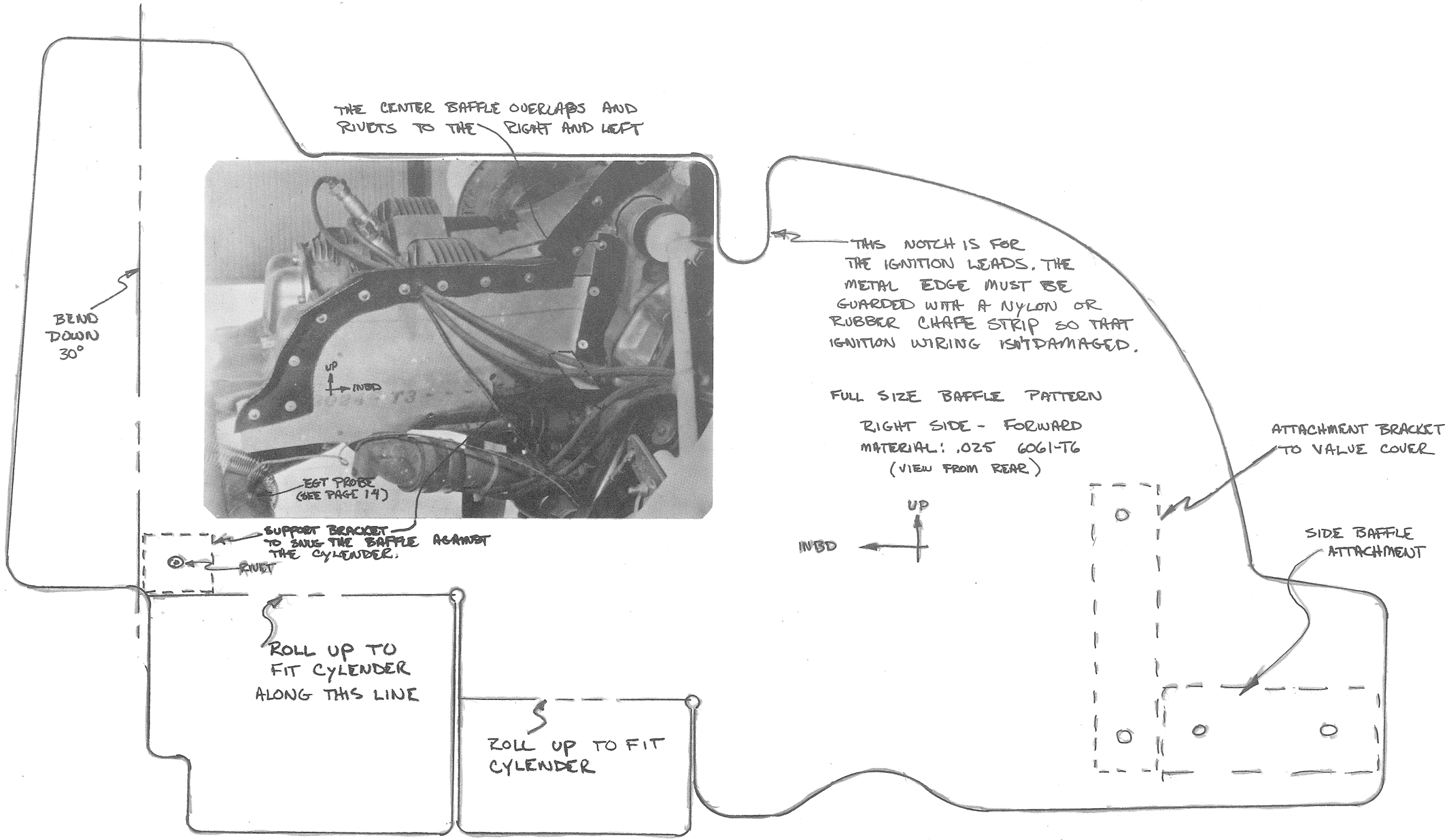


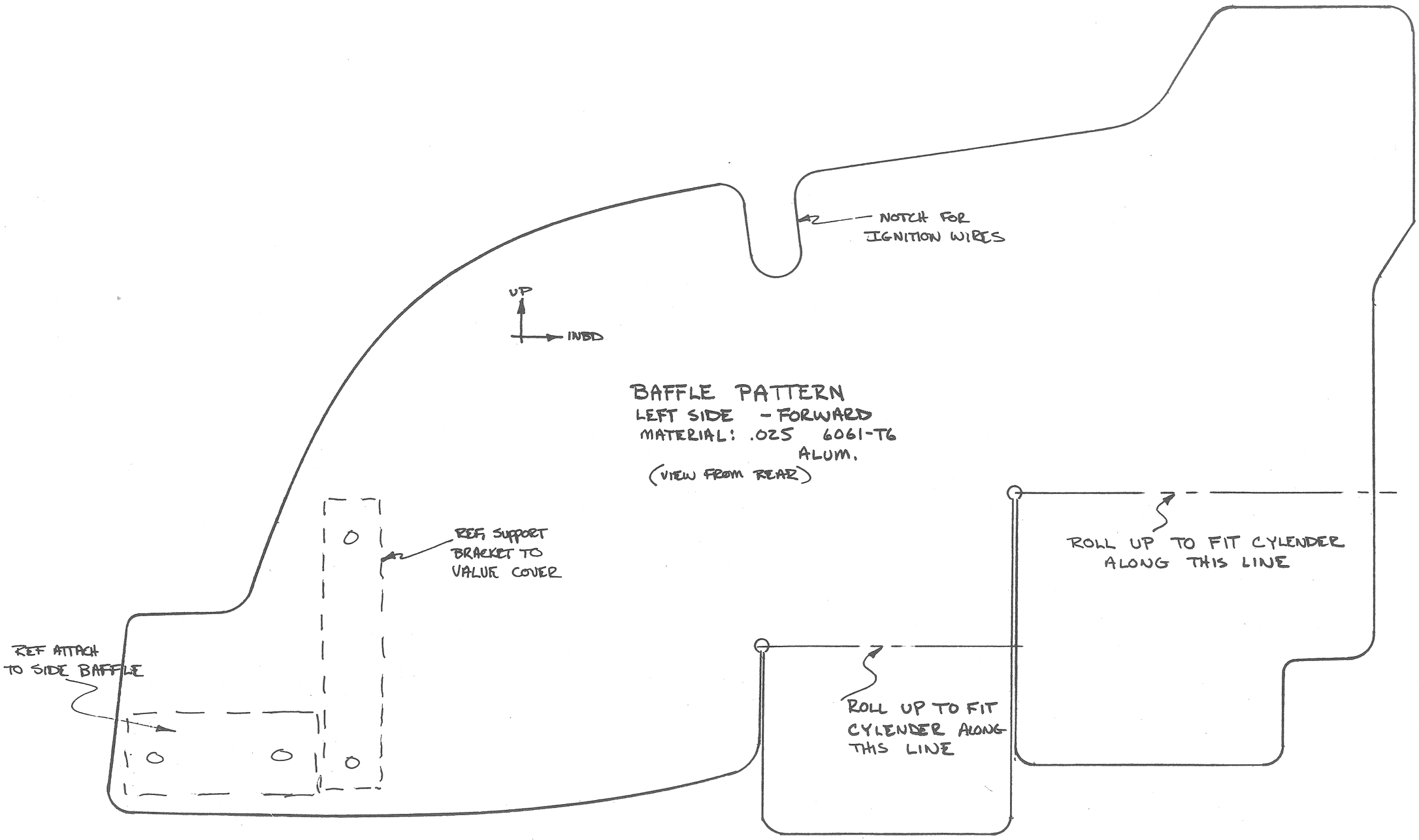


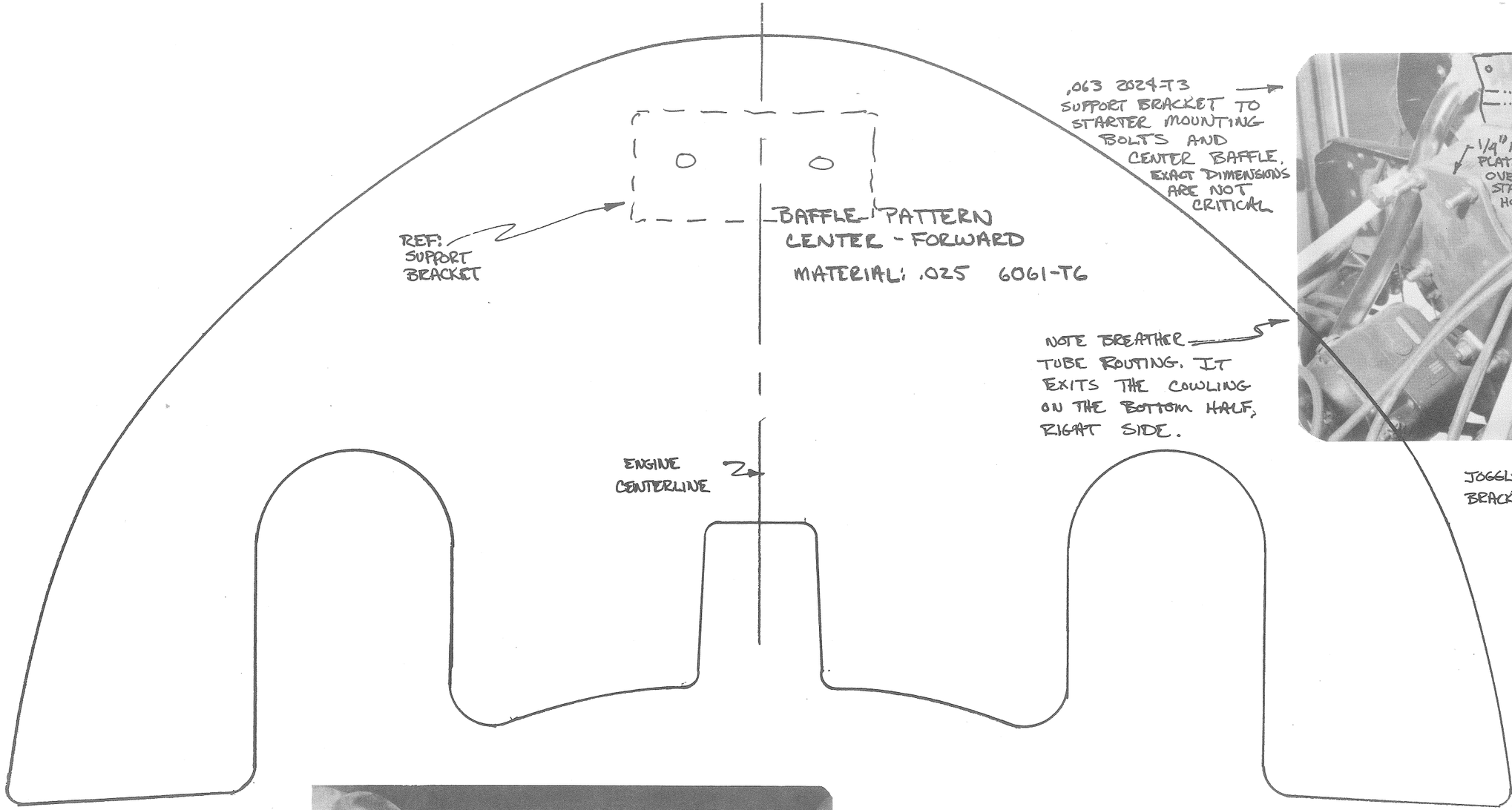


VIEW A-A
SHOWING HOW THE SIDE BAFFLES ATTACH TO THE FRONT AND REAR BAFFLES

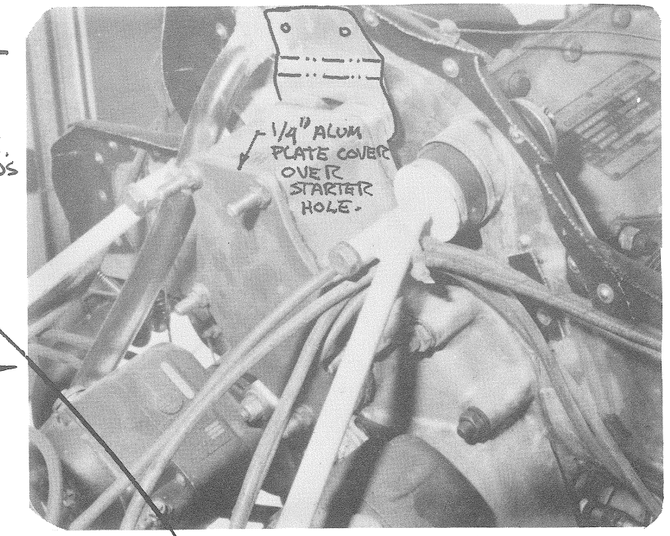



THE CENTER BAFFLE OVERLAPS AND RIVETS TO THE RIGHT AND LEFT
BEND DOWN 30°
UP
INBD
EGT PROBE (SEE PAGE 14)
SUPPORT BRACKET TO SNUG THE BAFFLE AGAINST THE CYLENDER.
RIVET
ROLL UP TO FIT CYLENDER ALONG THIS LINE
ROLL UP TO FIT CYLENDER
THIS NOTCH IS FOR THE IGNITION LEADS. THE METAL EDGE MUST BE GUARDED WITH A NYLON OR RUBBER CHAFE STRIP SO THAT IGNITION WIRING ISN'T DAMAGED.
FULL SIZE BAFFLE PATTERN
RIGHT SIDE - FORWARD
MATERIAL: .025 6061-T6
(VIEW FROM REAR)
UP
INBD
ATTACHMENT BRACKET TO VALVE COVER
SIDE BAFFLE ATTACHMENT

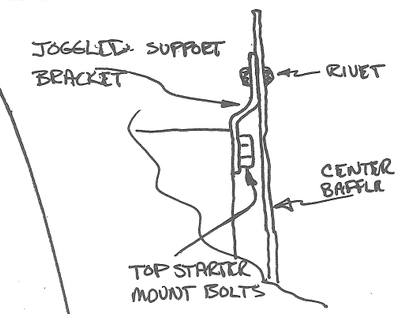

NOTCH FOR
IGNITION WIRES
UP
INBD
BAFFLE PATTERN
LEFT SIDE - FORWARD
MATERIAL: .025 6061-T6
ALUM.
(VIEW FROM REAR)
REF. SUPPORT
BRACKET TO
VALVE COVER
ROLL UP TO FIT CYLENDER
ALONG THIS LINE
REF ATTACH
TO SIDE BAFFLE
ROLL UP TO FIT
CYLENDER ALONG
THIS LINE



.063 2024-T3 SUPPORT BRACKET TO STARTER MOUNTING BOLTS AND CENTER BAFFLE. EXACT DIMENSIONS ARE NOT CRITICAL



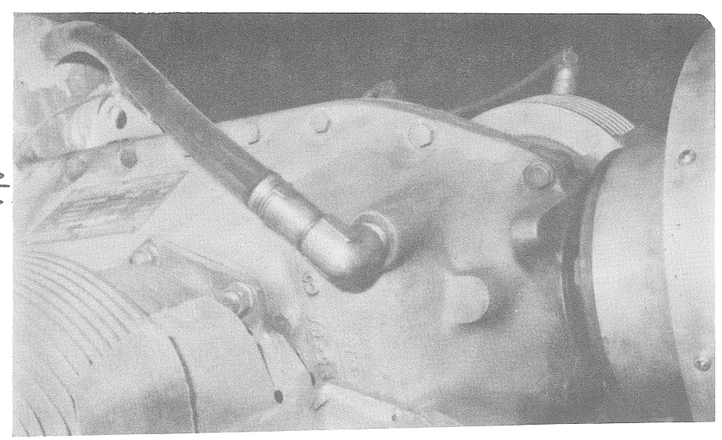
NOTE BREATHER TUBE ROUTING. IT EXITS THE COWLING ON THE BOTTOM HALF, RIGHT SIDE.



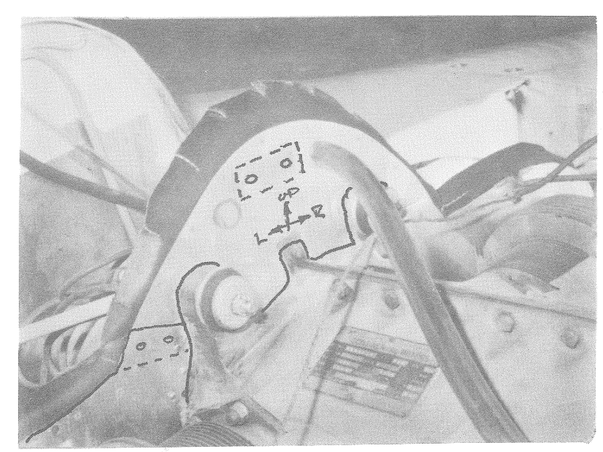
SIDE VIEW
SUPPORT BRACKET INSTALLATION

BREATHER TUBING
TYGOTHANE
0505-165
(5/8ID)

CRANKCASE BREATHER IS ORIENTED FWD AND UP OVER THE ENGINE.



NOTE BREATHER TUBE ROUTING THROUGH BAFFLE. EXACT LOCATION NOT CRITICAL.



Step 14

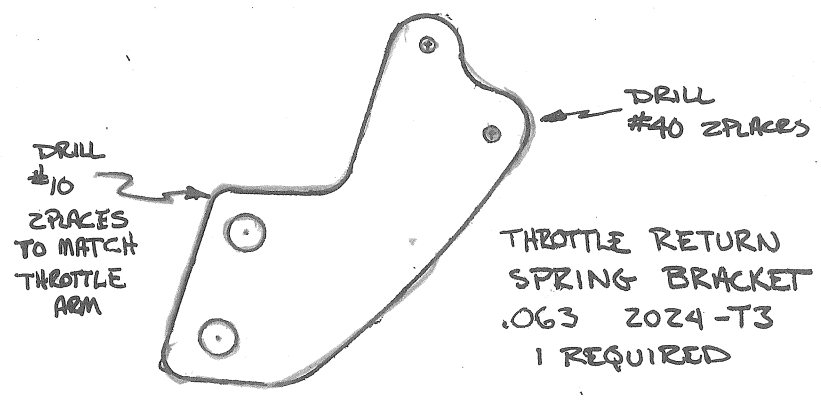
Engine Wiring and Controls

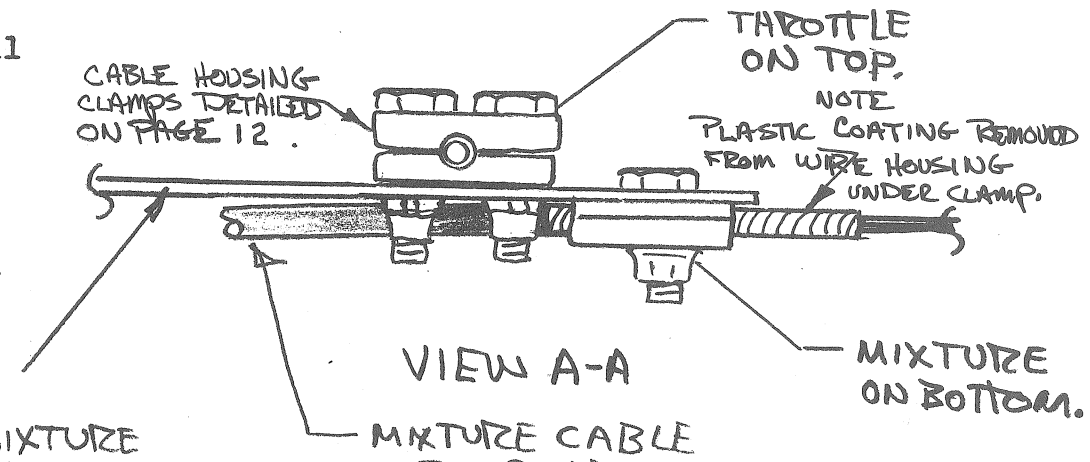
It is helpful (not required) to have an assistant to verify control positions and travel in the cockpit while you work on the engine.

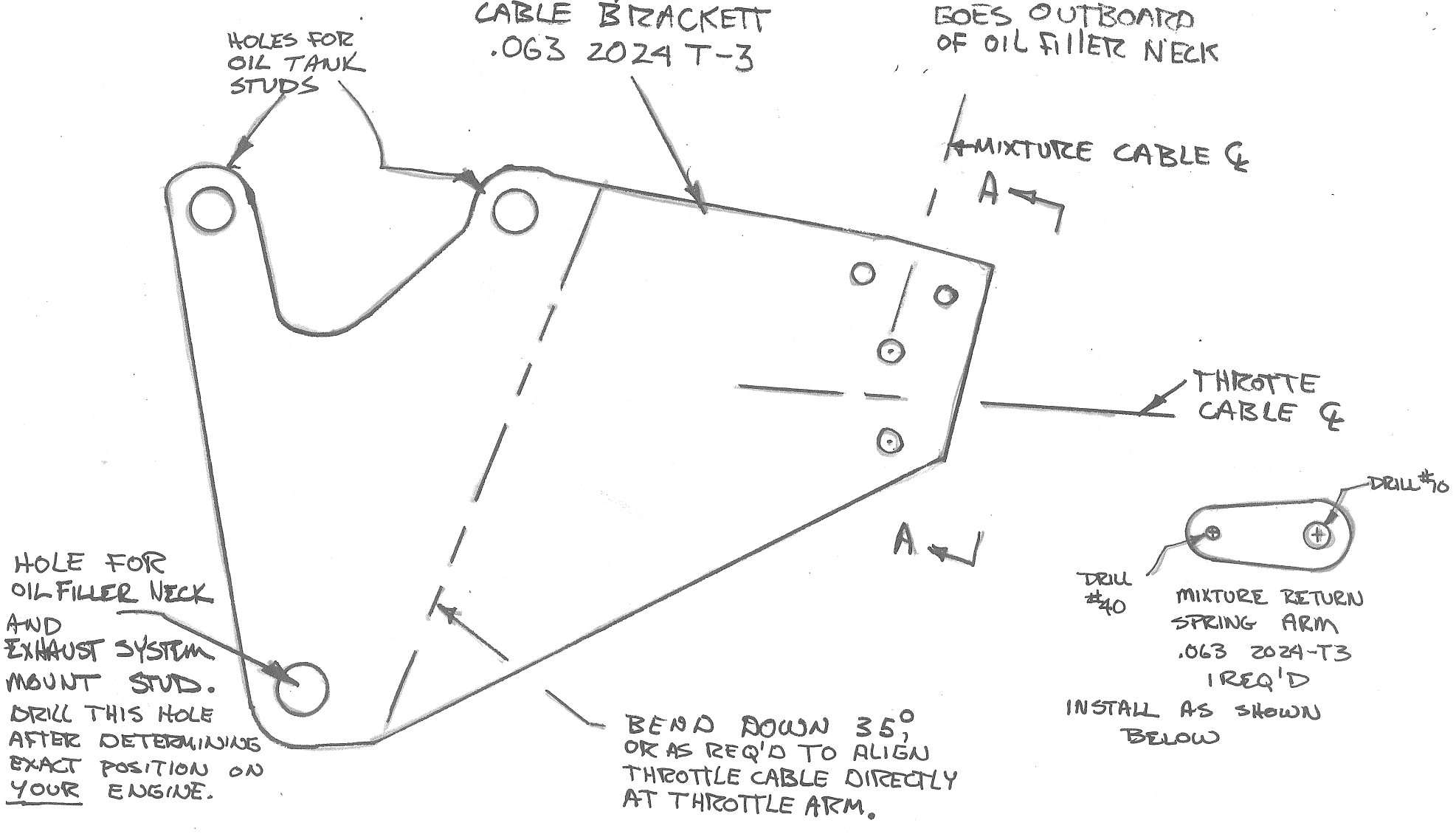
First, make all of the metal parts shown.

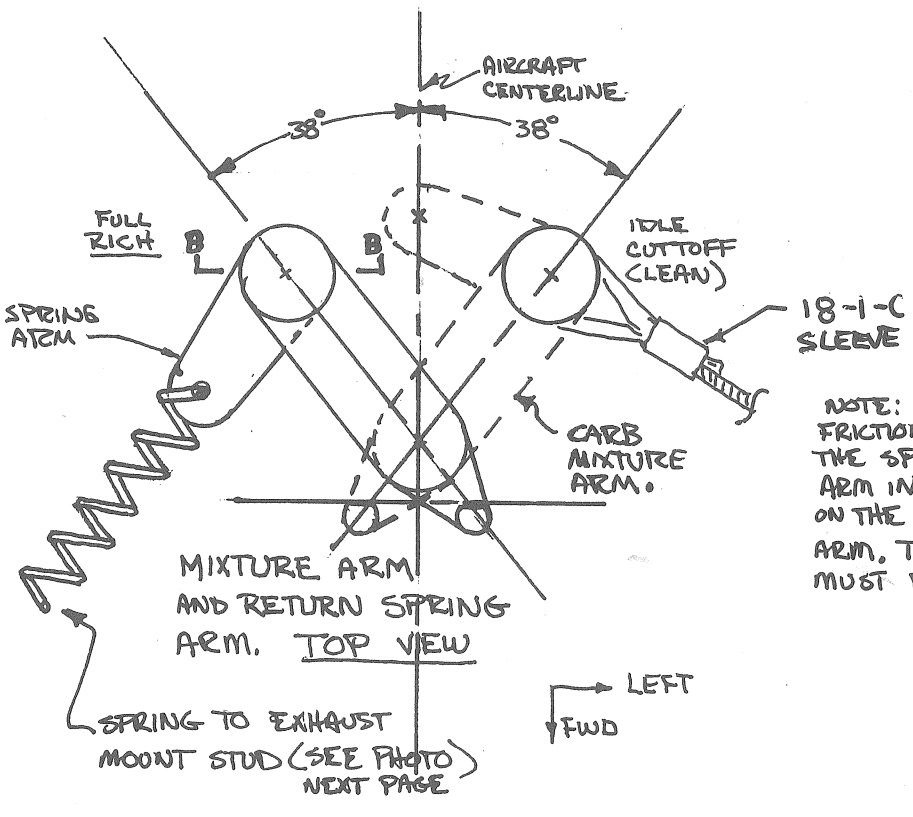
Install the throttle/mixture bracket on the lower left side of the engine, as shown in the photographs, using two of the oil sump tank studs and the exhaust system support stud to attach the bracket. It may be necessary to loosen all of the oil tank nuts and lower the oil tank slightly in order to install the bracket. A 5/16 ID x 1/2" long spacer is required between the oil filler support tab (also on the exhaust support stud) and the bracket.

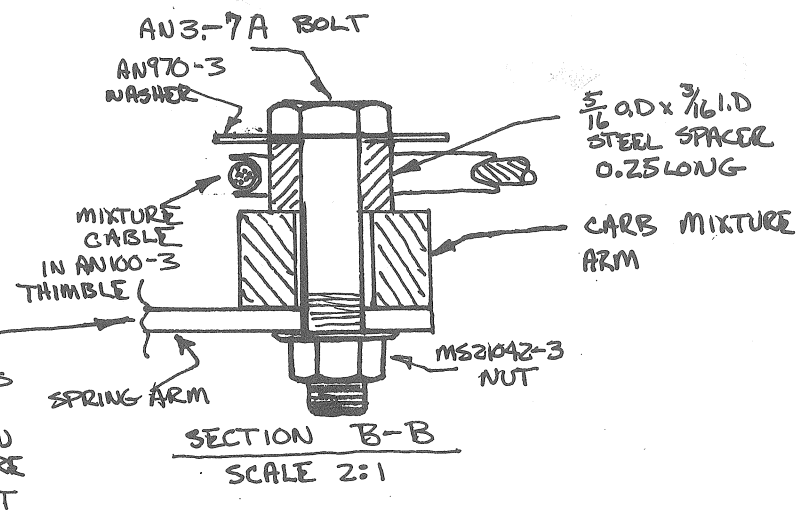
Next run your mixture cable and housing, which are both still excessively long, from the firewall, over the oil tank, to the mounting bracket. The cable housing must be left slightly slack to allow for engine movement.

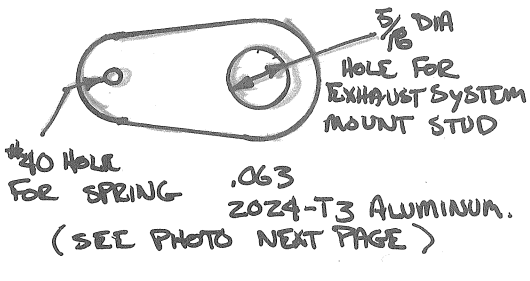


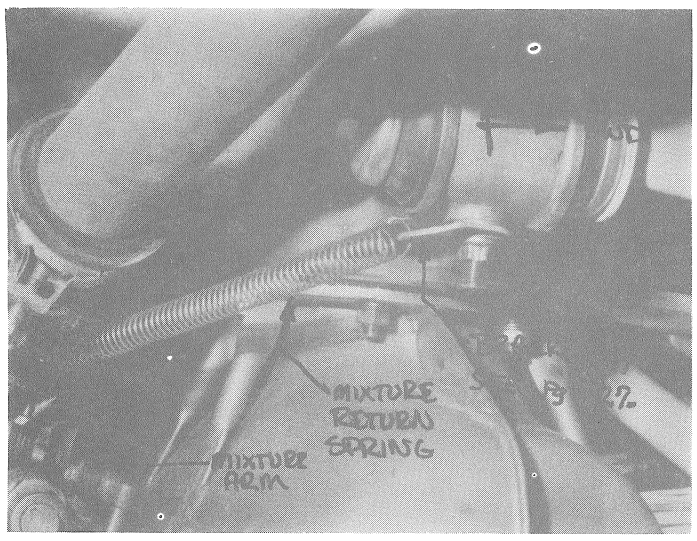




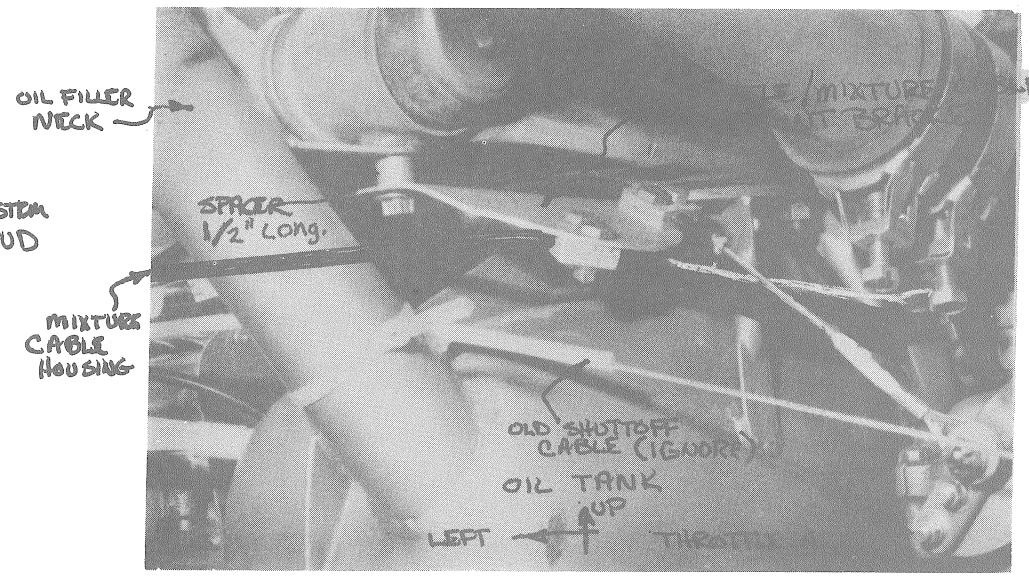








MIXTURE RETURN SPRING INSTALLATION



THIS PHOTO SHOWS THE GENERAL MOUNT ARRANGEMENT OF THE THROTTLE/CARB MIXTURE CABLE BRACKET. THE LENGTH OF THE BRACKET AND CABLE HOUSING CLAMP LOCATIONS HAVE BEEN CHANGED SINCE THIS PHOTO WAS TAKEN. FOLLOW THE DRAWING ON THE PRECEEDING PAGE FOR THESE DETAILS. THE OLD FUEL SHUTTOFF CABLE HAS BEEN MOVED TO THE FIREWALL AS SHOWN IN STEP 4.

Mark the cable housing to be trimmed so that it protrudes about 1/2" beyond the housing clamp (installed on the bracket as shown). Before you try cutting the cable housing to final length try a practice cut way out on the end of the Housing. The idea is to use your dremel (stone grinding wheel) to grind part way through the housing wire, not into the cable (see sketch), and then break the wire with a twist (using pliers). Don't damage the cable inside. With the housing cut to length you can use your dikes to cut the cable. Be sure you have enough extra cable to make a loop around the AN100-3 thimble. Install the mixture arm bracket on the carburetor mixture arm as shown. Hook up the light return spring as shown (Century Spring Corp #161). This spring moves mixture to full rich if cable fails. Clamp the cable between your thumb and finger and verify that you have full mixture travel at the carburetor when the mixture control is cycled in the cockpit before you swage the sleeve. If you don't get it perfect an adjustment can be made at the housing clamp. Tighten the AN3-5A bolts and MS21042-3 nuts on the cable housing clamp. Add a dab of silicone rubber over the cut end of the cable; it will save some pain and expletives later.

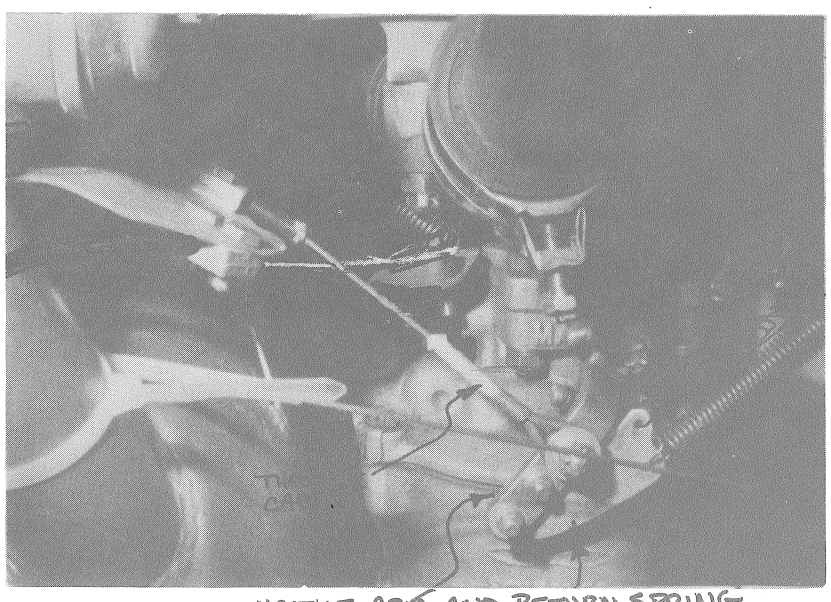
The throttle cable is installed in a fashion similar to the mixture. The return spring bracket is bolted to the throttle arm with two AN 3-5A BOLTS and MS21042-3 nuts as shown. Two Century Spring Corp. C-161 springs are used to preload the throttle in the full (open) position. The springs attach to the header tank mounting bracket (see page 17.). The throttle cable is swaged with an AN111-4 cable bushing and 18-1-C sleeve as shown. The cable is attached to the throttle arm with an AN 3-7A BOLT, 3/16 ID x 1/4 OD x .25 long spacer, AN970-3 washer, and MS21042-3 nut as shown inthe sketch. The AN111-4 <u>must rotate freely</u> on the spacer. Double check the throttle travel in the cockpit and at the carburetor before swaging. Dab the cut cable end with silicone rubber.

The carburetor heat cable housing clamp, cable, and return spring are installed as shown on page 11. Don't force the cable and housing around tight corners; leave enough slack for a gentle loop to the cable housing clamp.

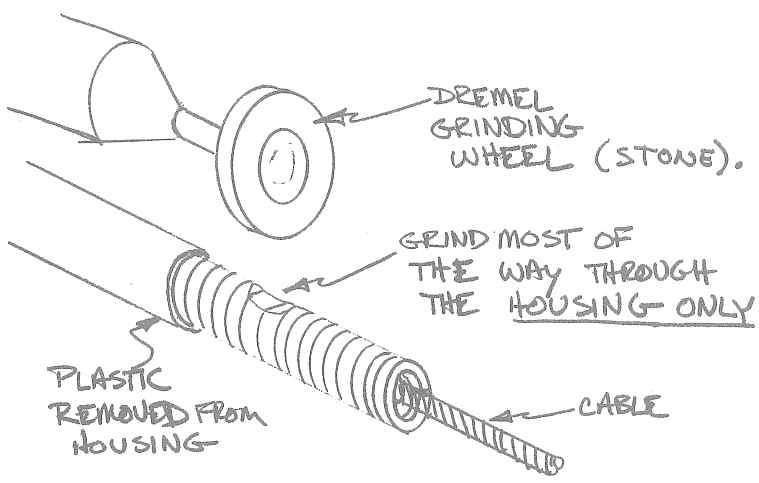
Next attach the ground wire from each magneto to the electrical wires running forward to the mag switches. A schematic diagram is shown for the installation of mag wiring on page 4.

Connect the switches to the aircraft ground as shown. Connect the aircraft ground wire (#10 or #12) to one of the engine mount bolts using an RC10-14 solderless terminal. Install a short length of #10 wire from the mount to a convenient stud on the engine, also using RC10-14 connectors.

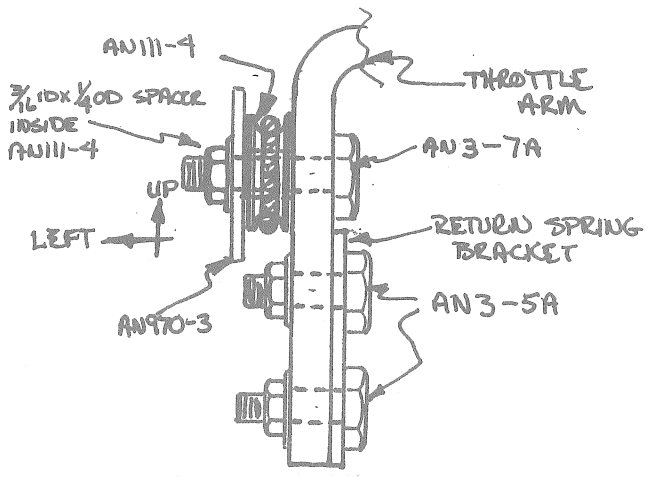
Install your CHT probe on the number 3 cylinder, top side (we recommend Westach #712-5W probe and 270A6P gauge). During your initial runs and initial flights you should move the probe to other cylinders. Once the hottest cylinder is determined, leave the probe on it. All cylinders on N4EZ run within 20°F of each other. If you have a wide variation the probable cause is mixture distribution. Follow your engine

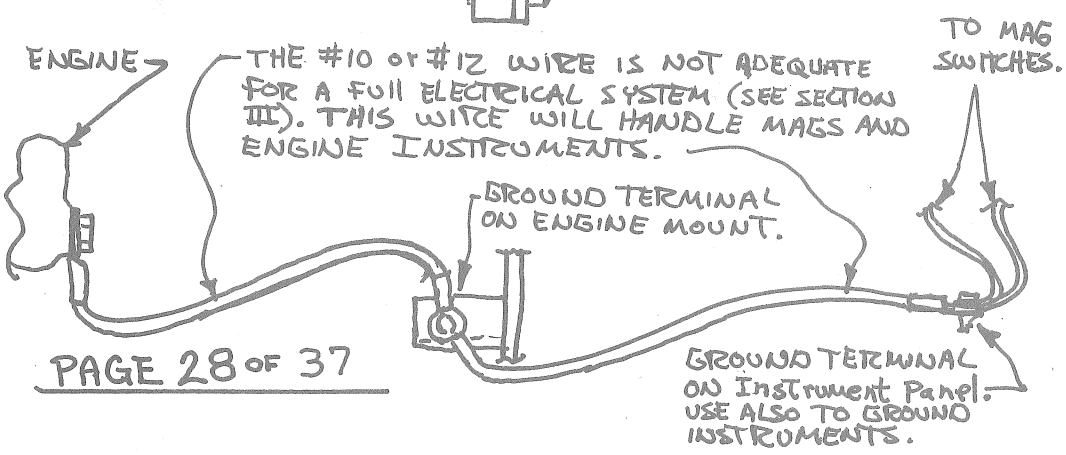


THROTTLE ARM AND RETURN SPRING BRACKET



THROTTLE ARM & HARDWARE VIEW LOOKING FORWARD.



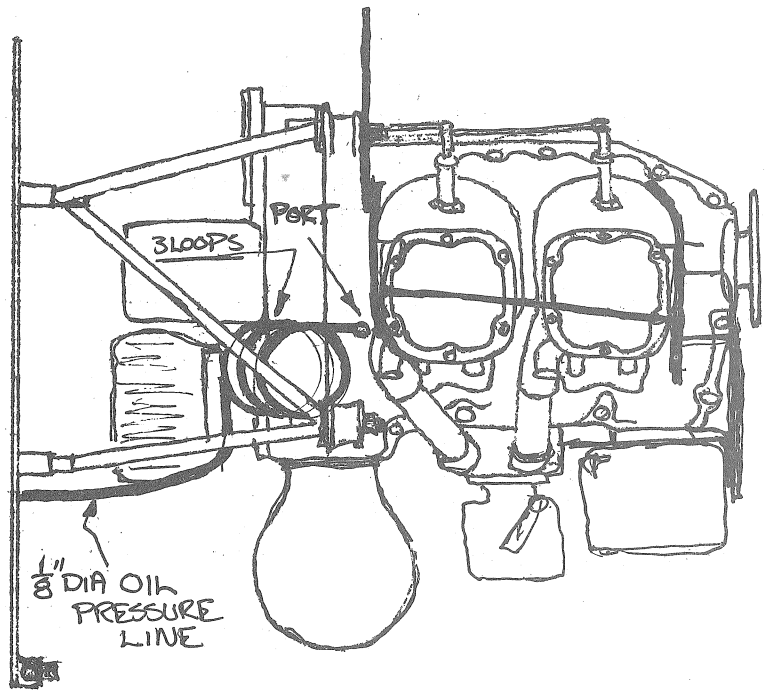


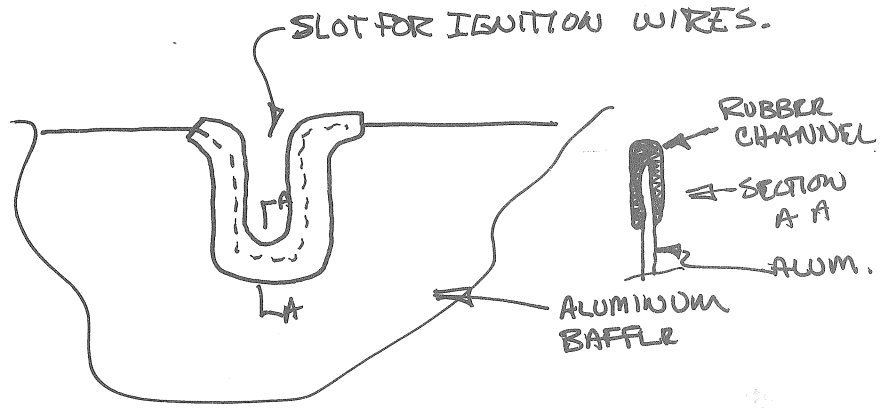
service manual and route the ignition wiring (spark plug leads) to each plug.

Snug the plug caps (shielded harness only) using a 3/4" wrench; don't over tighten. Be sure to guard the ignition wires against chafing on the cylinder cooling baffles using a nylon "caterpillar" or rubber channel AS SHOWN.

The exhaust gas temp probe should be installed on number 2 cylinder exhaust pipe as shown ON PAGE 14 & 24. Oil temperature may be direct reading (144-in capilary tube) or magneto-powered (Westach #299A2M with #399S sender). Install the sender as recommended in your engine service manual. If you have a 12V electrical system, we recommend the Westach #299A2 gauge and the #399S sender.

The oil pressure line from the engine to the firewall canbe done two ways. The fancy way is to run aeroquip 601-4 armored flex hose from an AN816-4D fitting in the engine to another AN816-4D fitting tied to the engine mount with nylon tie-strap and use an Imperial Eastman 86-L (ALUMINUM) female connector (1/8" dia to 1/8" NPT) to join the oilpressure line to it. The simple way is to run the 1/8" dia oil pressure tubing direct (making three loops BETWEEN THE FIREWALL AND ENGINE for vibration isolation) to the engine oil pressure port using an Imperial Eastman 88-L (ALUMINUM) male connector. The only disadvantage of the simple approach is that you need to be careful not to bash the oil pressure line while working in the engine compartment. WITH EITHER SYSTEM, be sure to route and tie the lines to avoid vibration and chafing.





Step 15
Cowling Installation

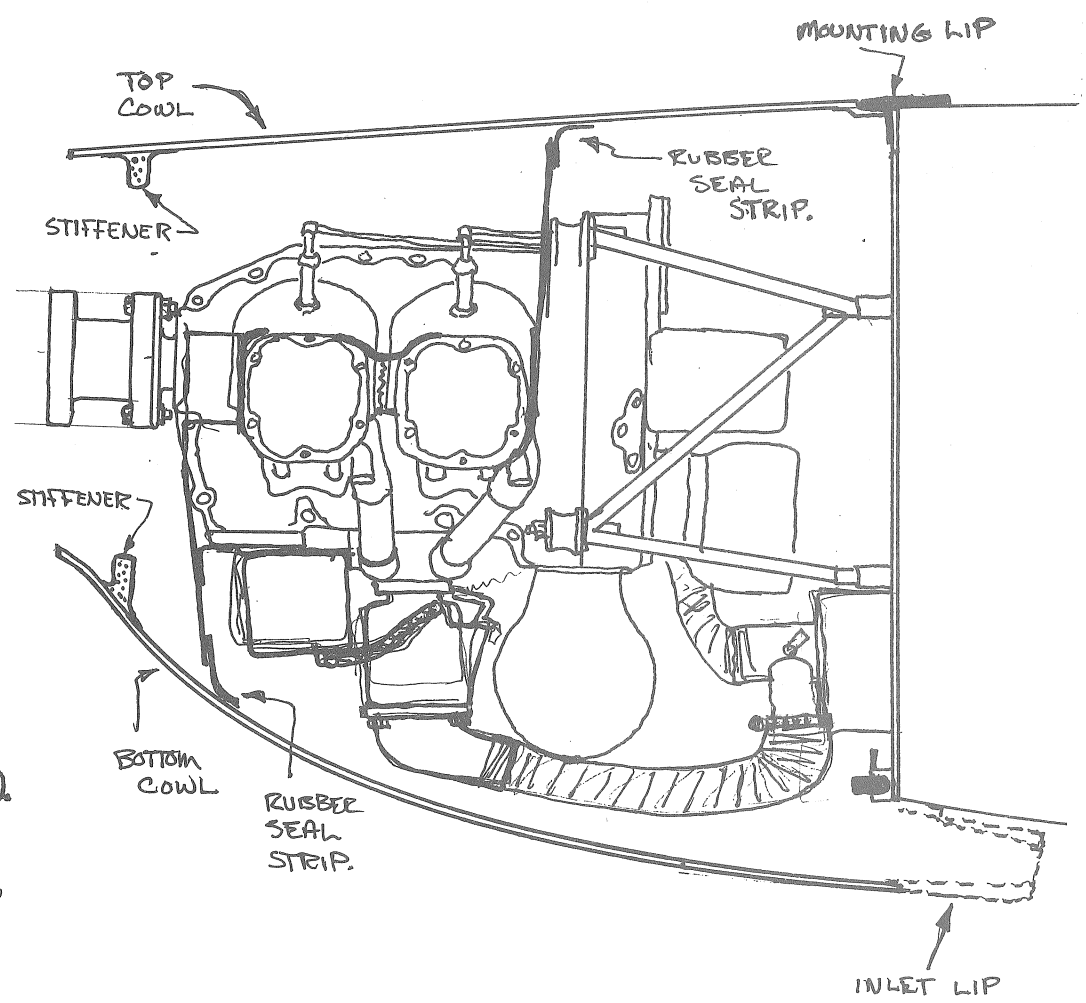
Moulded fiberglass cowling halves with primer gel-coat finish are available from a VariEze distributor. Installation instructions accompanying the distributor-supplied cowling parts may update this step or expand upon it.

The vendor-provided cowling halves will require some additional work as part of the installation on your airplane. You will have to trim the outboard ends to fit your wings, jig the cowl to fit your firewall and engine properly, locate and install the fiberglass end ribs (vendor supplied), layup an attaching flange along the fuselage and spar, install the attaching hardware, and fabricate a composite inlet lip which is sized for your engine. You will also fabricate a sheetmetal oil-check door and access panels for your rudder quick-disconnects if desired.

Those builders who wish to fabricate their own cowling rather than buying, will find dimensional definition at the end of this step (PAGE 32).

The cowling is attached to the airplane with #10-32 screws(AN507), nutplates (K-1000-3), and countersunk washers. Camlok type fasteners may be substituted as a quick-disconnect feature along the end ribs and top to bottom cowl joint. Camloks in the fuselage makes cowling installation and removal more difficult. Dzus-type fasteners should not be used because they don't provide adequate shear load-carrying capability.

The distributor-supplied cowling is intentionally supplied extra wide. Hold it in position on the firewall and spar edges, mark along the inboard wing root and trim to fit. with both sides, top, and bottom trimmed spanwise locate the end ribs inside the halves and cleco in position.



THE GENERAL COWLING ARRANGEMENT

Assemble the top amd bottom cowl halves together before installing them on the fuselage. Use clecos to hold the halves together for temporary positioning and initial fitup. You may find it desirable to shift a hole slightly on final installation, so save the screw/nutplate or camlok installation until the cowling is fitted to the airplane.

Before you can proceed with the cowling installation you have to cut a hole in the bottom cowl for the exhaust system to exit the cowling.
The position of these holes varies with engine (the A-65 is inboard of the 0-200 for instance). These holes must be oversize so that engine operational movement is allowed for and so that the cowl can be installed and removed without brutality. This involves enlarging the exhaust exit hole forward so that interference with the mounting flange that you're about to install can be avoided. See THE SKETCHES ON PAGE 31. A slot must be cut in each end rib to allow the rudder cable and conduit stub to pass through while installing the lower cowl. Once the cowling can be positioned on the airplane, it is held into position using scrap wood blocks bondoed to the airplane and clecoed to the cowling as shown in the sketches.

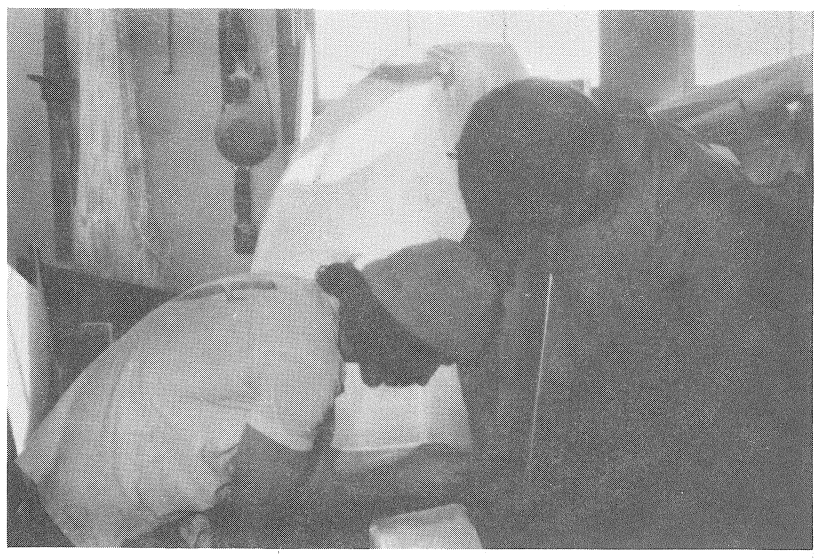
Locate your spinner backplate on the prop extension and crank shaft. Check that the clearance from cowl is fairly equal top and bottom. Space it if required. Check that the trailing edge of the wing root agrees with the cowling trailing edge. THE VERTICAL LOCATION OF THE COWL CAN BE SHIFTED BY SLIPPING THE TRAILING EDGES OF THE COWLING HALVES LATERALLY WITH RESPECT TO EACH OTHER.

Lay grey tape over the cowl edges adjoining the fusealge and center section spar as shown. This will keep the flange layup from sticking to the cowl.

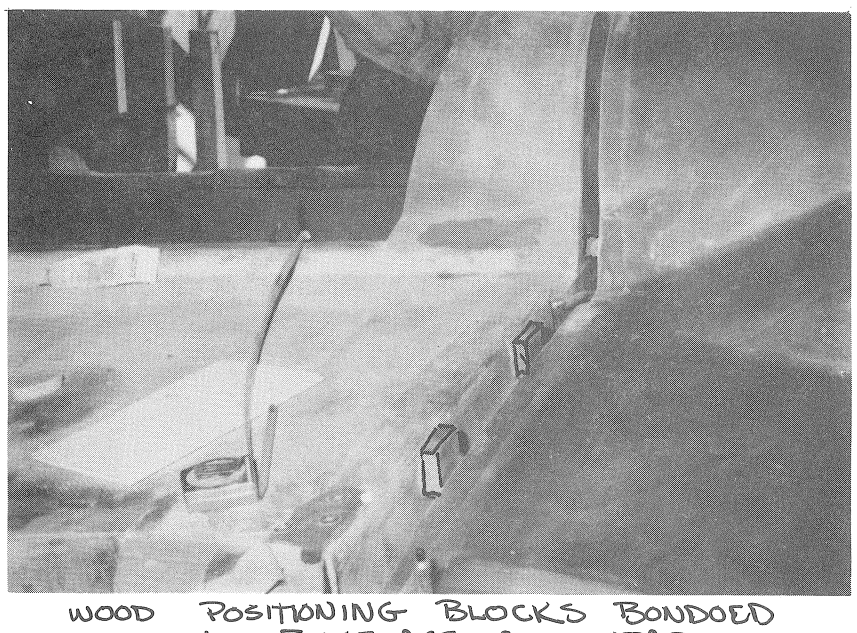
Next sand the top rear edge of the center section spar and fuselage dull for bonding from the edge forward about two inches. Lay up six plies of BID (RAEF) as shown, along the forward edges of the cowl. Use 45° fiber orientation. Add 3 extra 1.5" square pads to reinforce the flange where the screws are installed (eight places, see next page).

Flip your airplane upside down and repeat the flange layup on the bottom side. Don't panic when the prop flange moves up toward the top cowl. This is because of the sag of the rubber shock mounts with the engine upside down. Rest the airplane on the top longerons and stack weights up forward to balance the engine weight. This is no job for one or two people; it helps to have many hands, most of them toward the rear. It helps to have the prop installed to use as a lifting point.

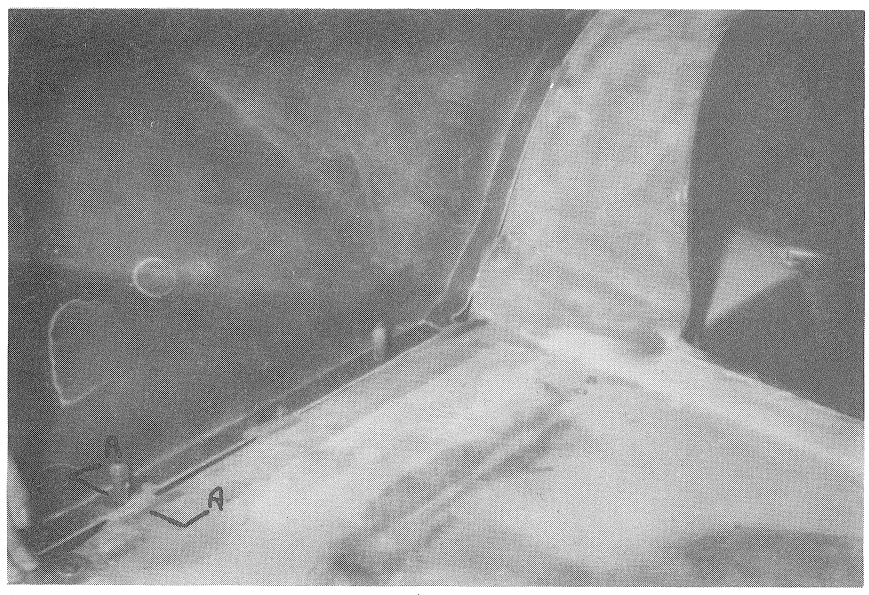
From this point on, the top cowl half must be removed first and installed last. After the glass is cured, carefully pop the top cowl free of the mounting flange. Do not peel the flange up off of the spar or fuselage. The glass will not adhere to the tape but you may have to run a thin flexible knife blade under the flange glass to pop it free of the cowl (a cheap pairing knife is useful). Remove the top cowl and the bottomcowl. The mounting flange next gets a 2-ply BID tape inside along the



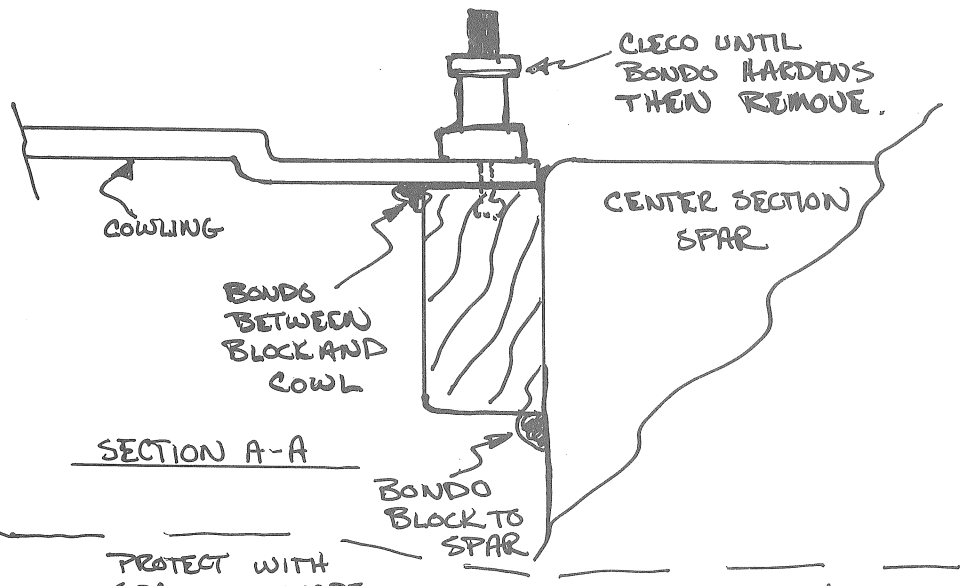
ASSEMBLE THE TOP & BOTTOM COWLING HALVES ON THE BENCH

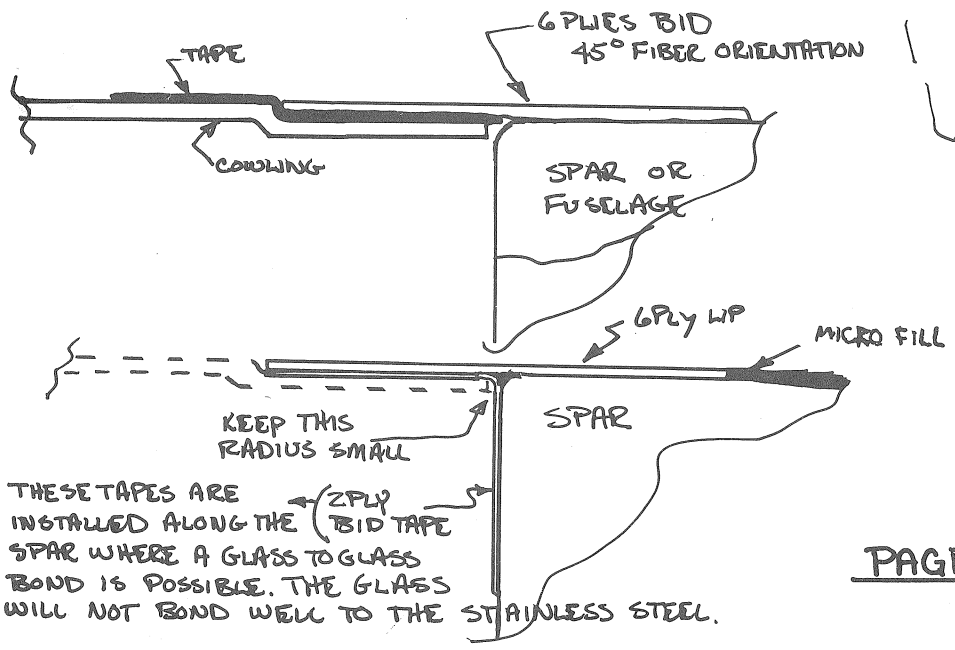


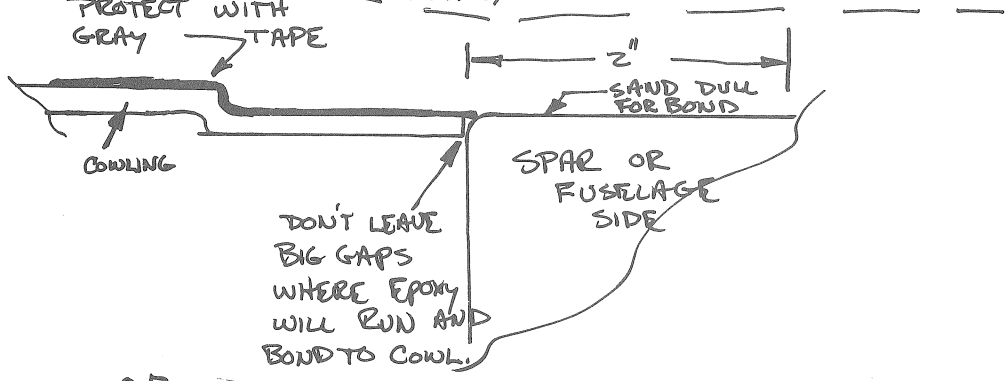
WOOD POSITIONING BLOCKS BONDOED TO THE FUSELAGE AND SPAR (SEE SECTION AA BELOW)



COWLING CLECOED IN POSITION ON LOCATING BLOCKS

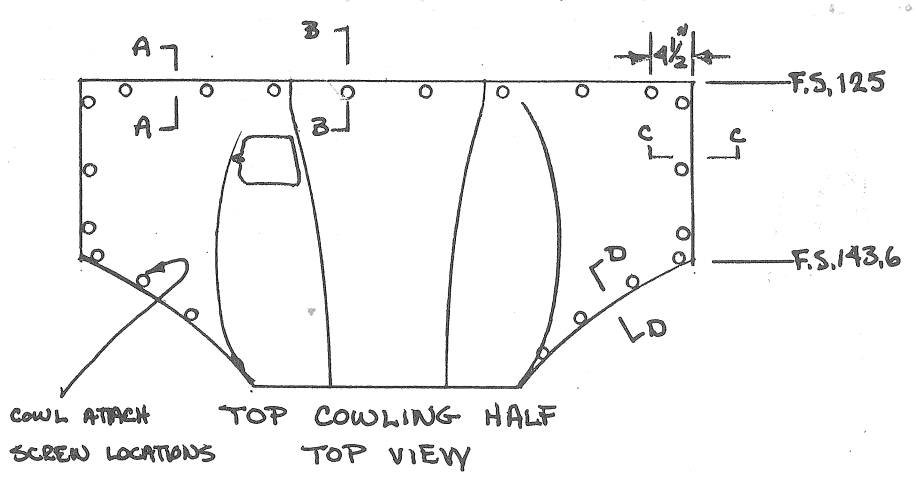


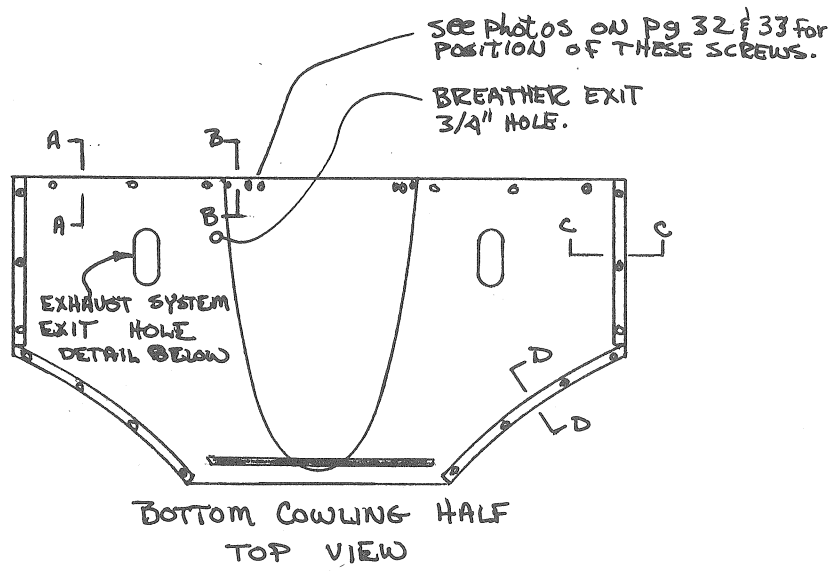


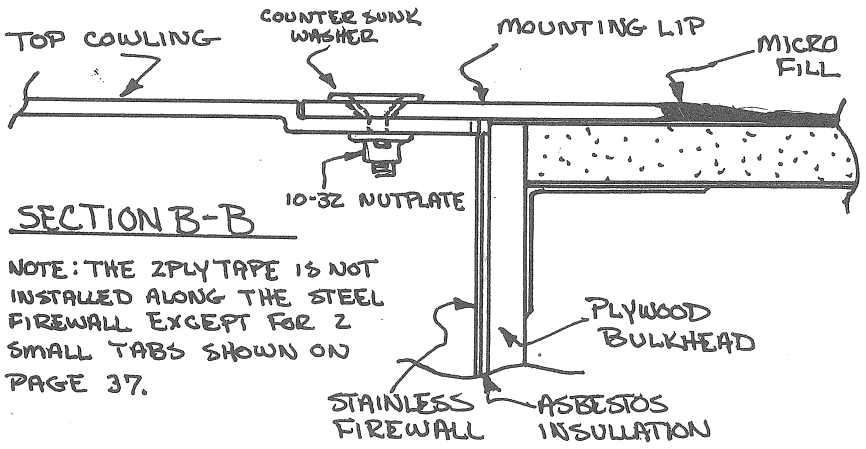


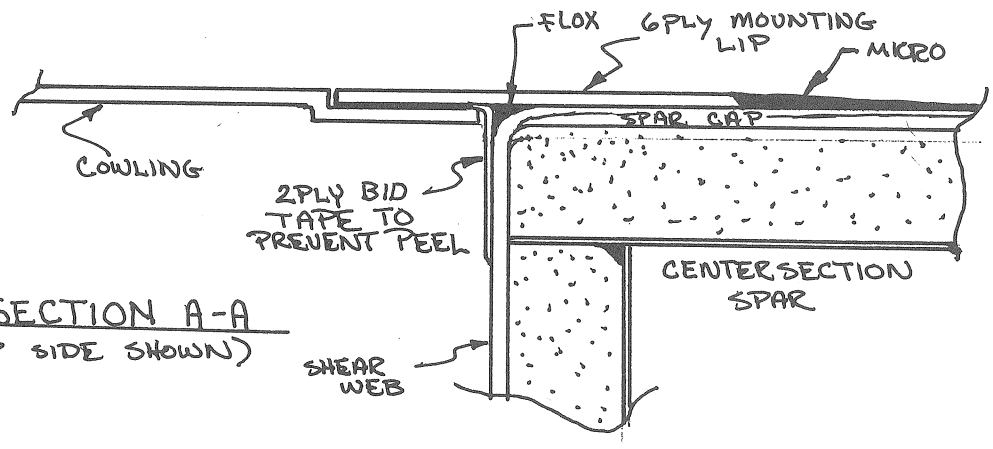
spar as shown. Of course you must sand the cured surfaces dull before the tapes are laid up. Turn your airplane right side up again and install #10 screws (507's) with countersunk washers (A3235-028-24A) and nutplates along the mounting flange. Camloks can be used in the forward flanges but assembly/removal is difficult since the cowl must drop down to clear the fasteners. The reason the cowl fits on the inside of the flange is that the cowl has higher pressure inside. If the flange were inside the pressure would tend to lift the cowl between fasteners, leaking air. Air leaks cause drag and results in cooling loss.

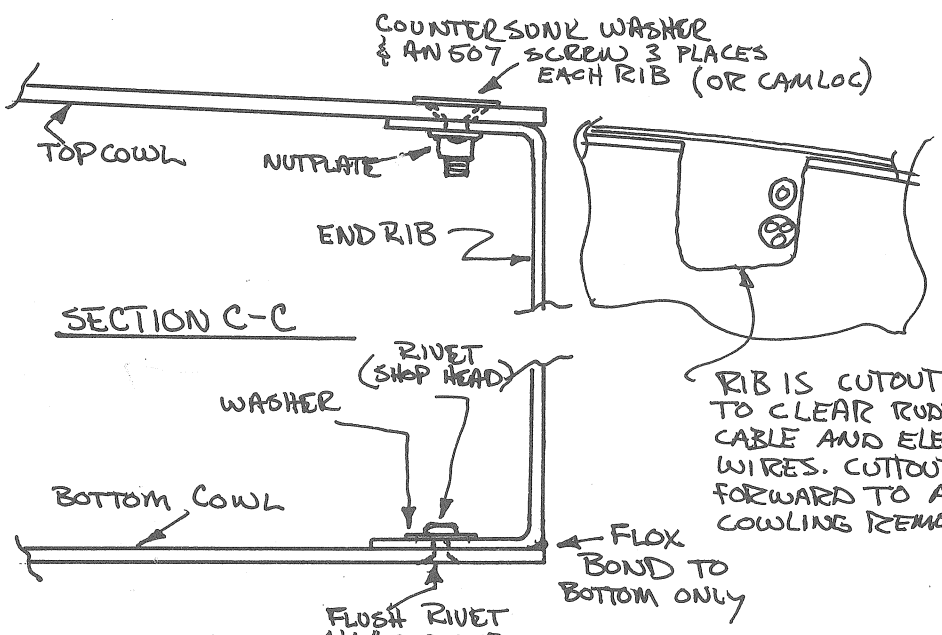
The fiberglass end ribs may be permanently installed on the bottom cowling by riveting and bonding with wet flox. Each rivet must have a small washer between the shop head and the fiberglass rib as shown in the sketch. A short 2ply BID tape as shown on page 37 is required at the lower edge of the mounting lip on each side. This little tape will help keep the mounting lip from peeling at the corners.

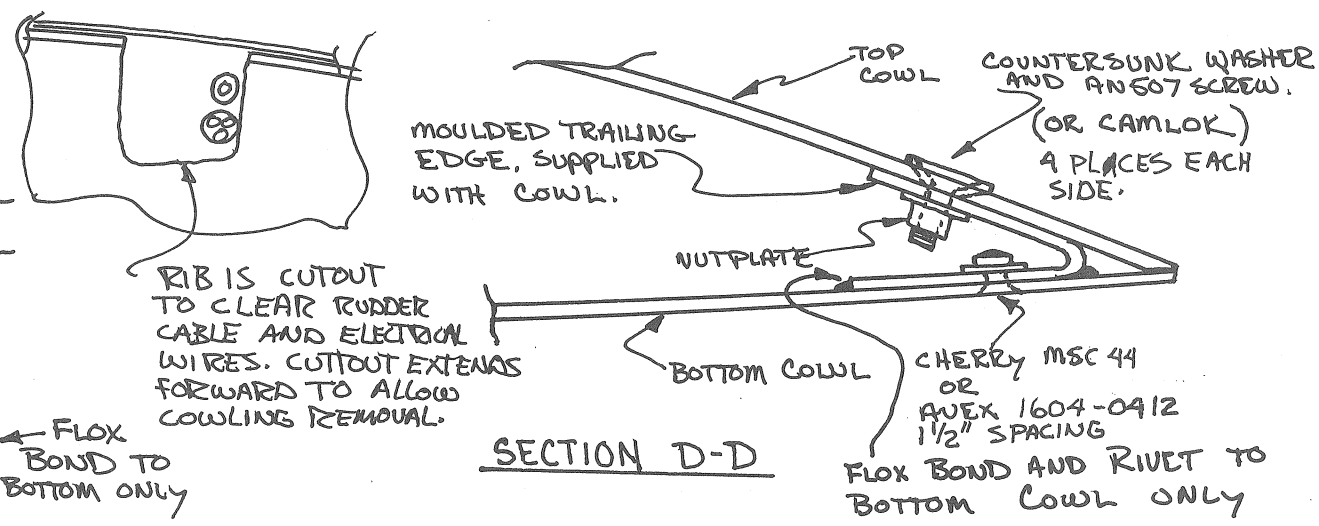


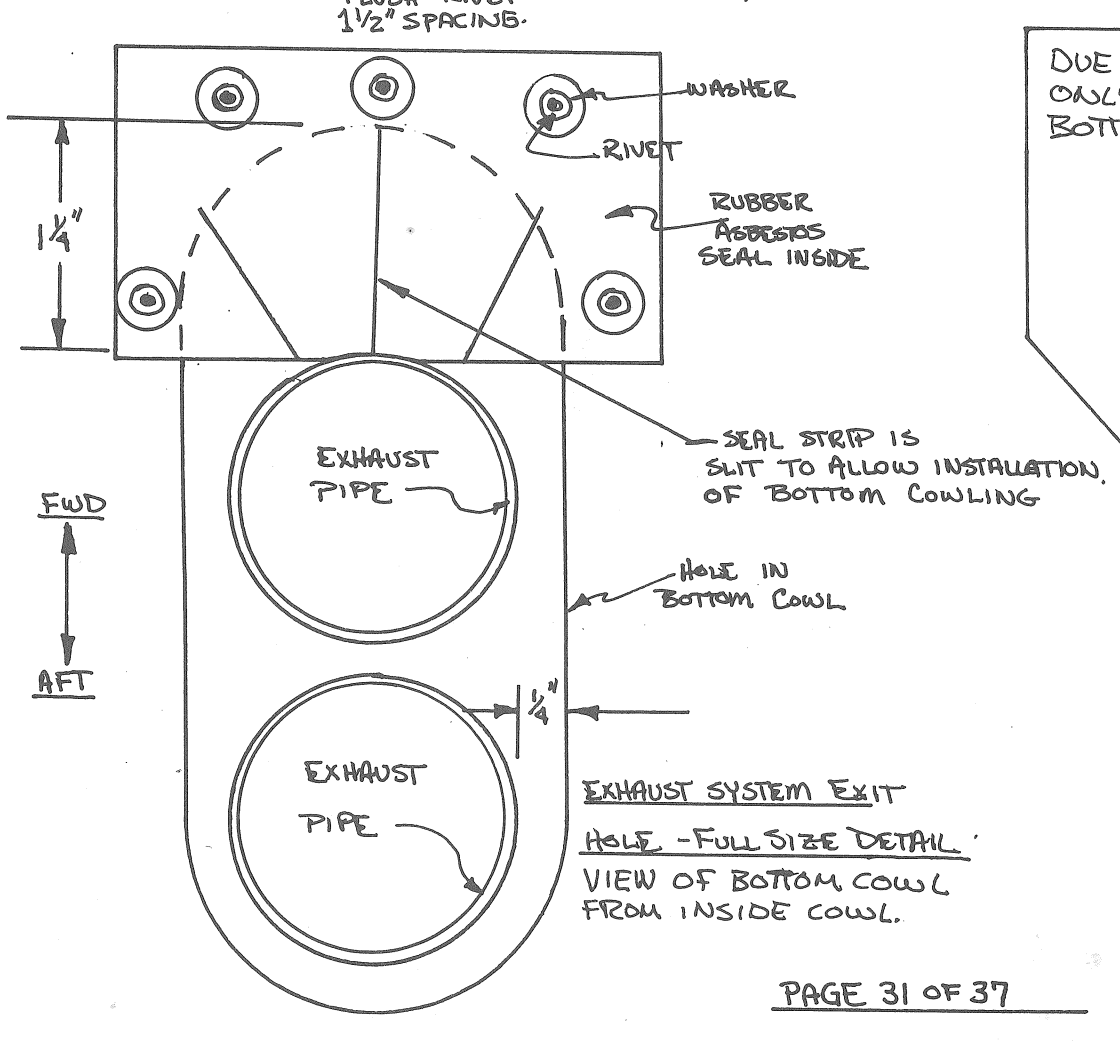












DUE TO THIER HIGH COST, CAMLOCS SHOULD ONLY BE USED IN THE TOP COWL. THE BOTTOM COWL IS NOT OFTEN REMOVED.

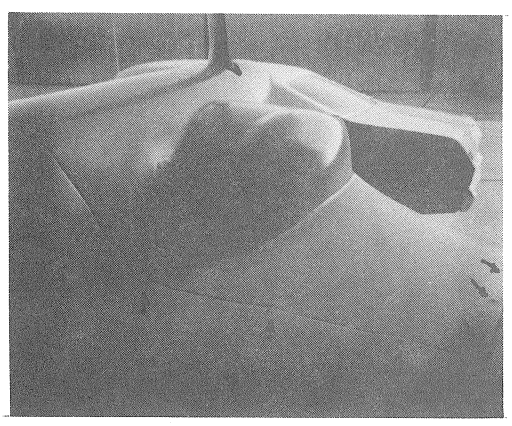
IF YOU SUBSTITUTE CAMLOC'S FOR THE AN507'S, USE THE FOLLOWING PART NO'S.

STUD
4002-6

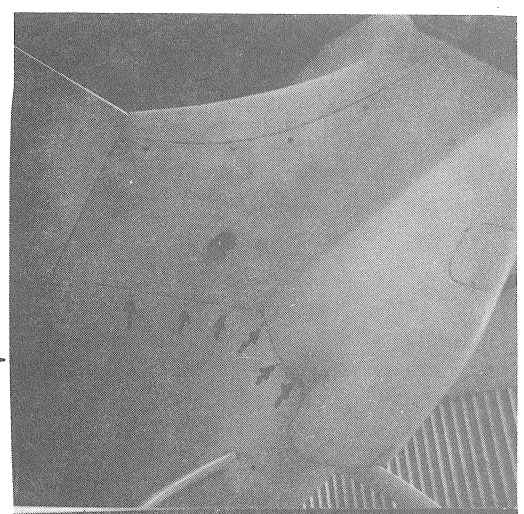
GROMMET
4002-0

RECEPTACLE
214-16N

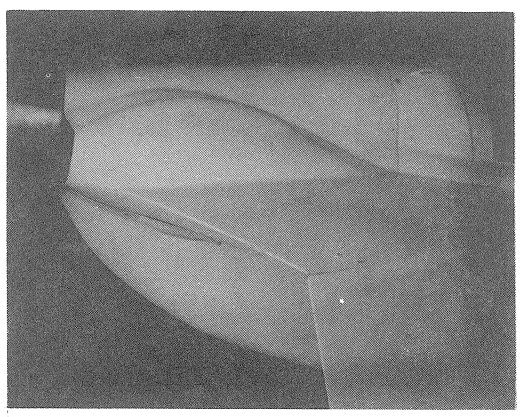
The information on this page is for use by those builders wishing to fabricate their own cowlings. Use the air outlet dimensions shown below and position at the fuselage stations shown on the side view. The cowling can be made by packing urethane foam around the mounted engine, carving to shape (photos), glassing with five plies BID generally, local buildups to eight plies (total) at the mounting edges and around the door openings, and removing the foam after cure. This method is messy. The cowling for N7EZ was made this way.

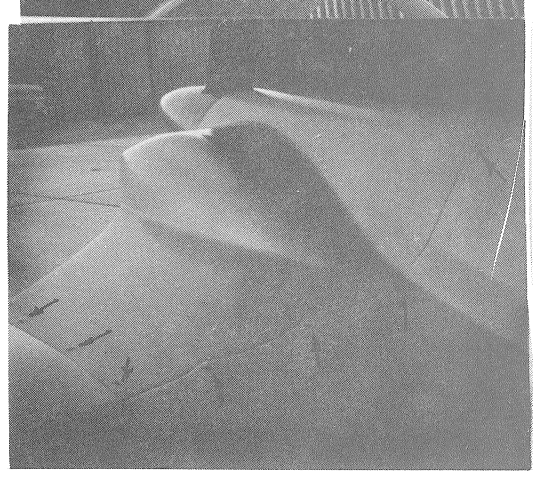


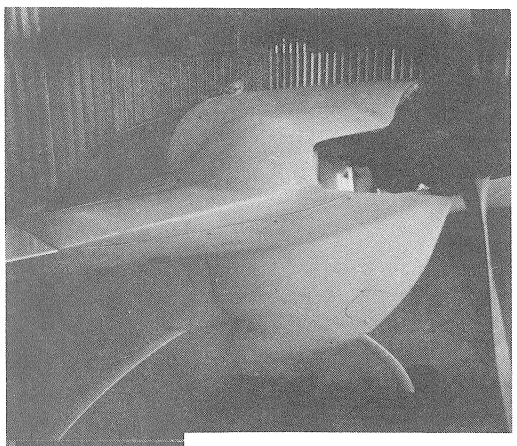
THE BOTTOM COWL DOOR SHOWN IN THIS PHOTO HAS BEEN DELETED AND THE ATTACHMENT OF TOP AND BOTTOM COWL AT THE TRAILING EDGE HAS BEEN REVISED.

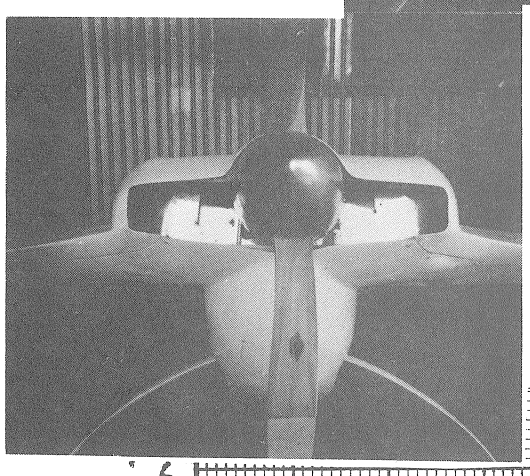


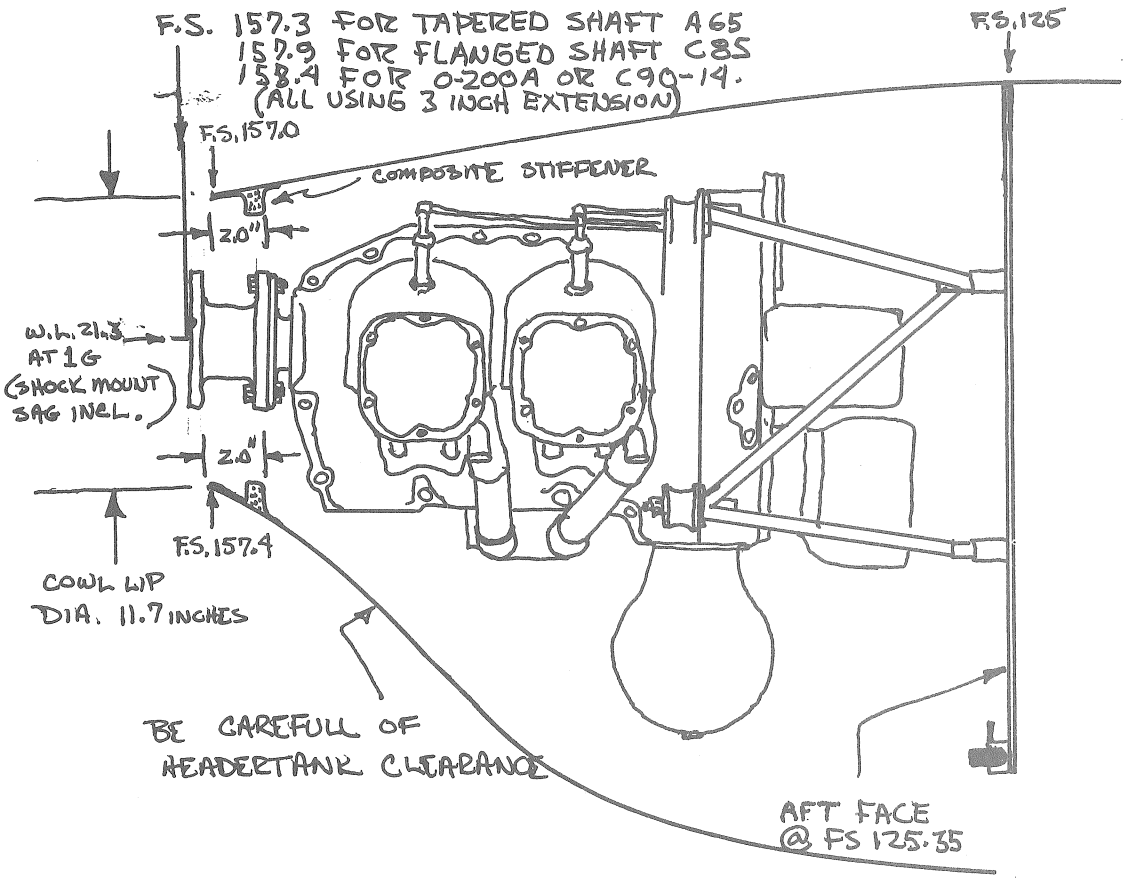
ARROWS SHOW POSITION OF ALL FASTENERS.

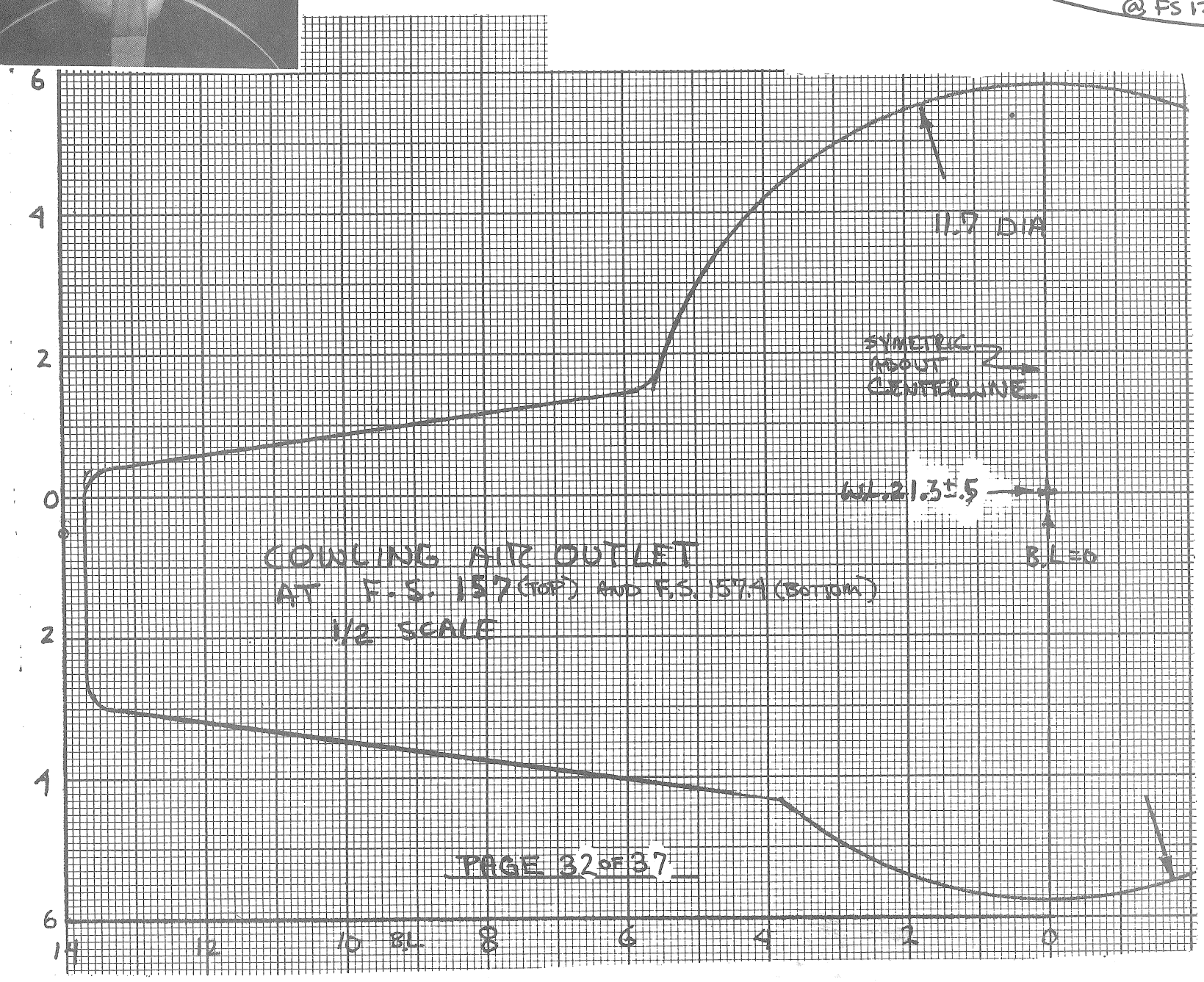








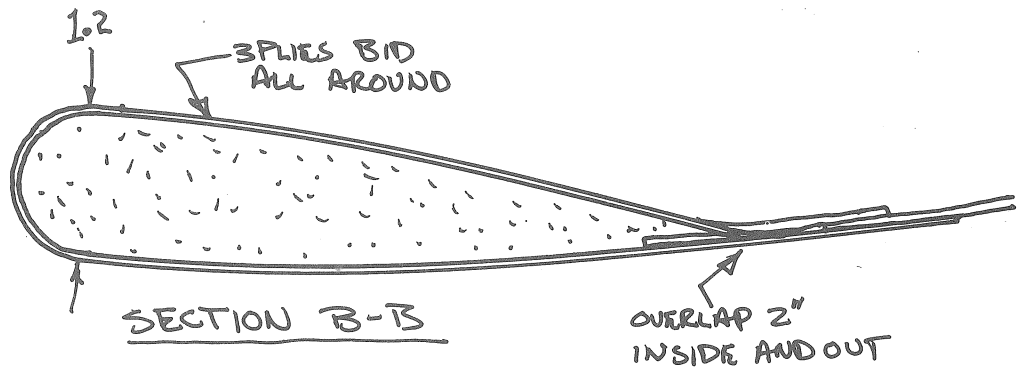


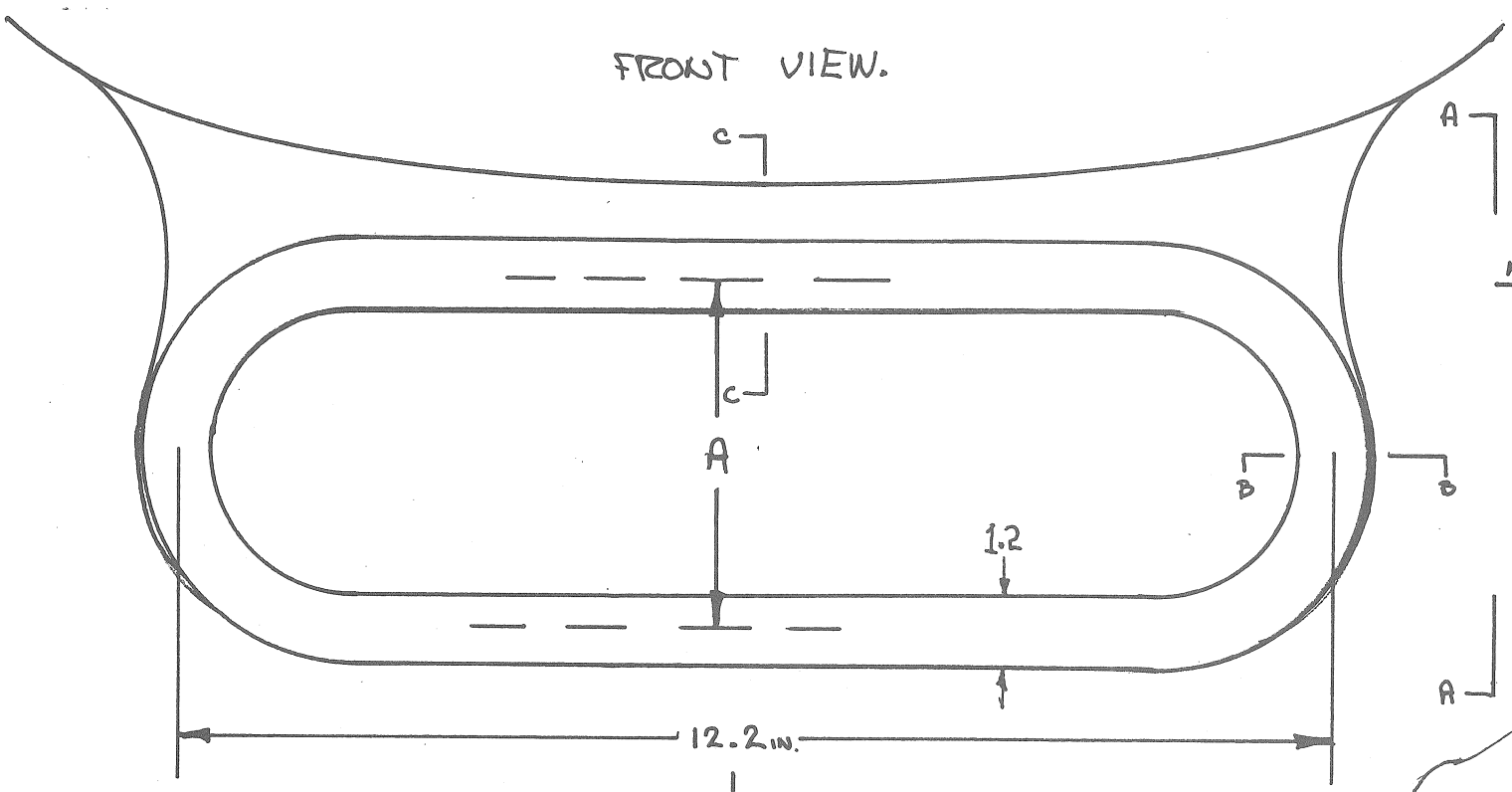


Inlet Lip

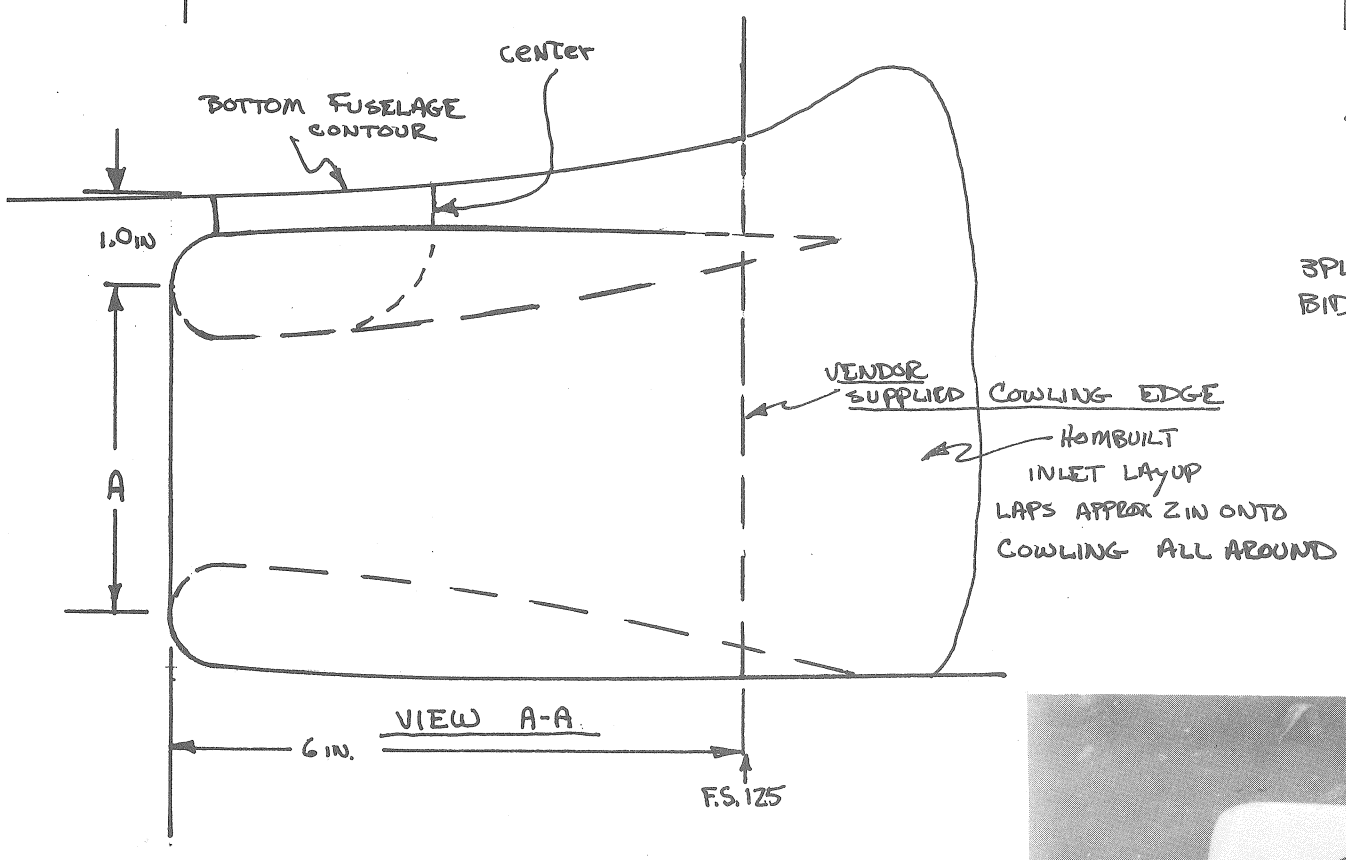
The cowling as supplied has no inlet lip for two reasons: (1) the various engine sizes (65 hp to 100 hp) require different inlet areas, (2) a homebuilt lip results in a lower cost cowl.

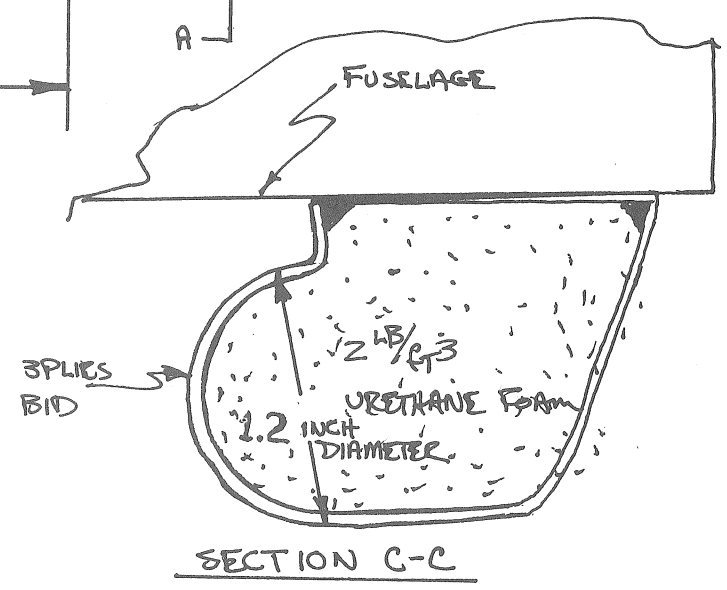
To make the inlet up, cut urethane foam strips as shown and glue in position with 5MIN or RAEF. Shape the lip as shown for your type engine. Sand the whole area as shown and lay up ~~THREE~~ plies BID over the foam lapping onto thecowl inside and outside.

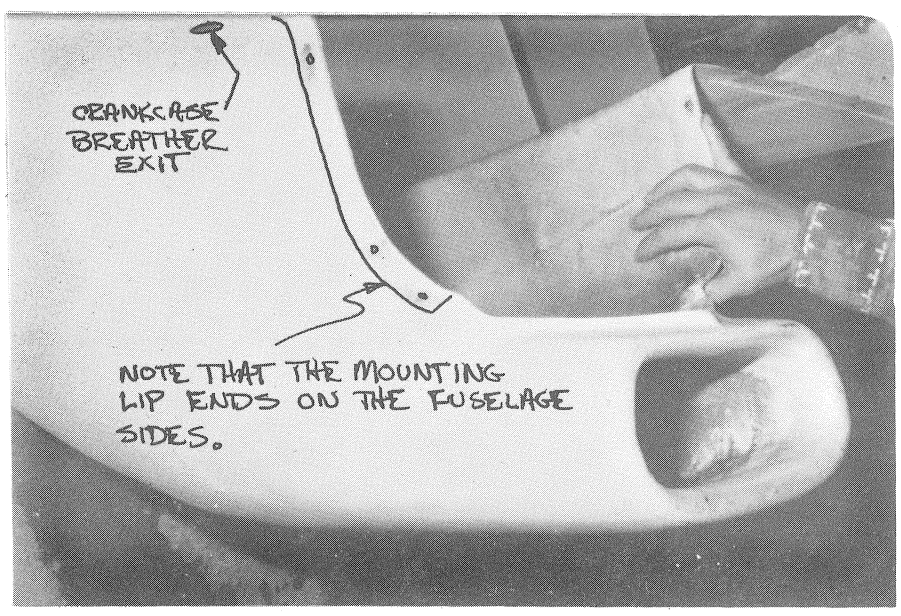


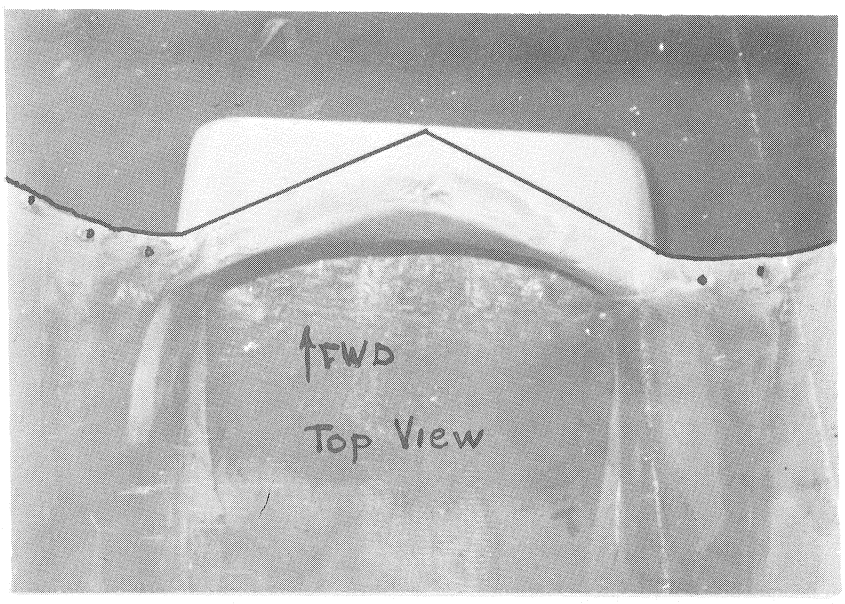


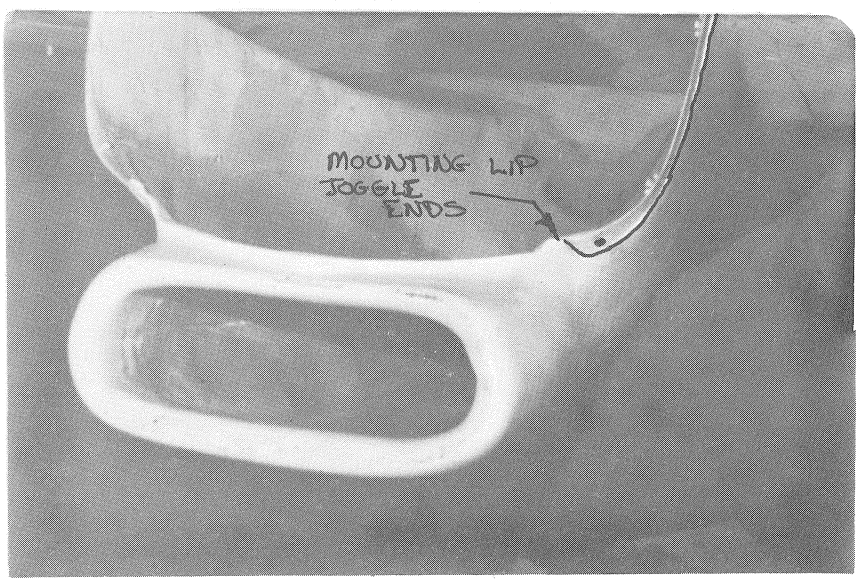
ENGINE HORSEPOWER	DIMENSION A
100	4.6
90	4.5
85	4.4
75	4.3
65	3.9









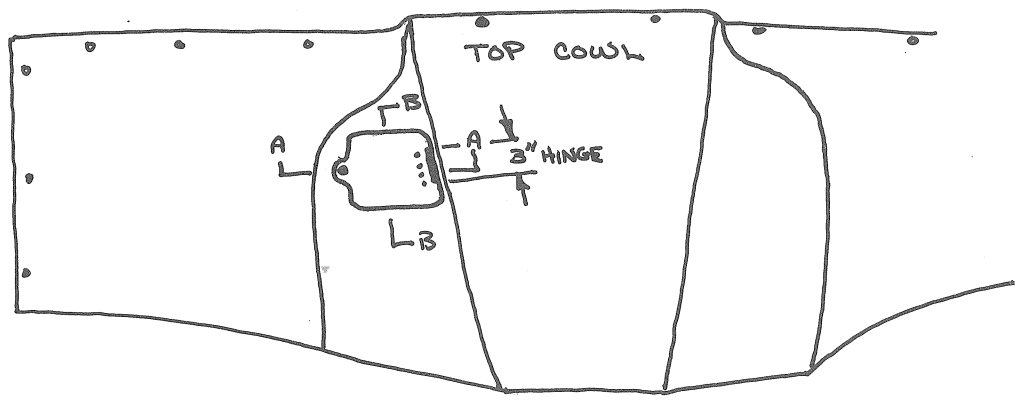


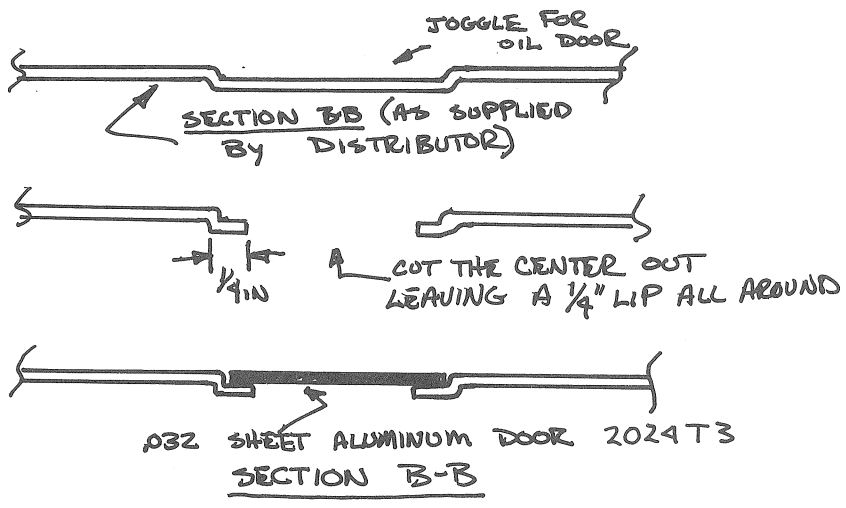
DETAIL PHOTOS OF THE PROTOTYPE COWLING INLET ON N4EZ

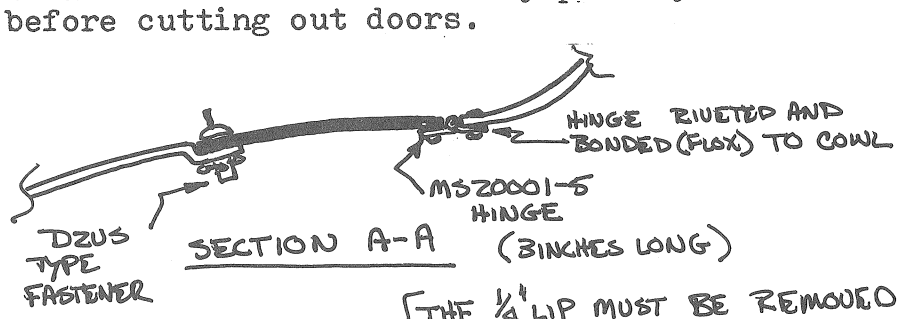
Step 16
Cowl Doors

We recommend only one cowling door, the one with the recess provided in the supplied cowlings. This door allows you to check the oil quantity, add oil, and inspect a limited area including accessories and the left exhaust system. If you're sure you are going to be removing your wings on a regular basis you may add doors over the rudder cable quick-disconnects to allow unhooking controls without cowl removal.

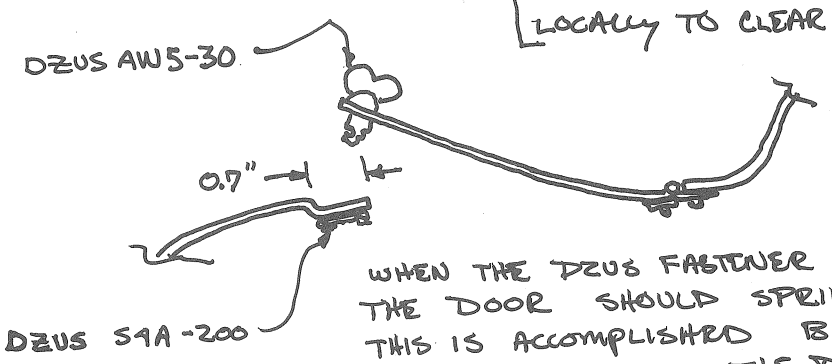
Note that the supplied cowling is reinforced around the area for the oil check door. If you want to install doors over the rudder disconnects, sand the inside and lay up four plies of BID the size of the door plus 1" all around. Let this layup fully cure before cutting out doors.



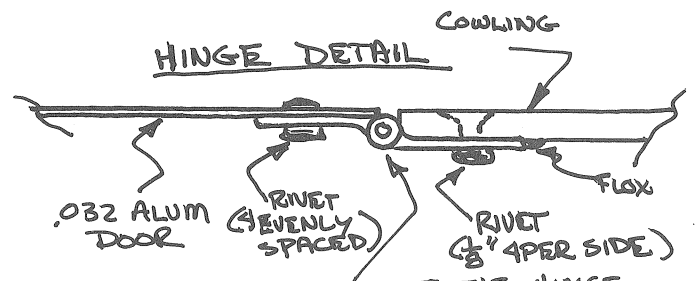




[THE 1/4" LIP MUST BE REMOVED LOCALLY TO CLEAR THE HINGE.]



WHEN THE DZUS FASTENER IS UNLATCHED THE DOOR SHOULD SPRING OPEN. THIS IS ACCOMPLISHED BY FORMING A SLIGHT CURVE IN THE DOOR BEFORE INSTALLATION. THIS PRELOADS THE DOOR TIGHTLY AGAINST THE COWL LIP WHEN CLOSED AND KEEPS AIR FROM LEAKING OUT AROUND THE EDGES



ONE HALF OF THE HINGE IS REVERSED TO MAKE UP THE DIFFERENCE IN THICKNESS OF THE COWL AND DOOR.

Step 17
Finishing Up

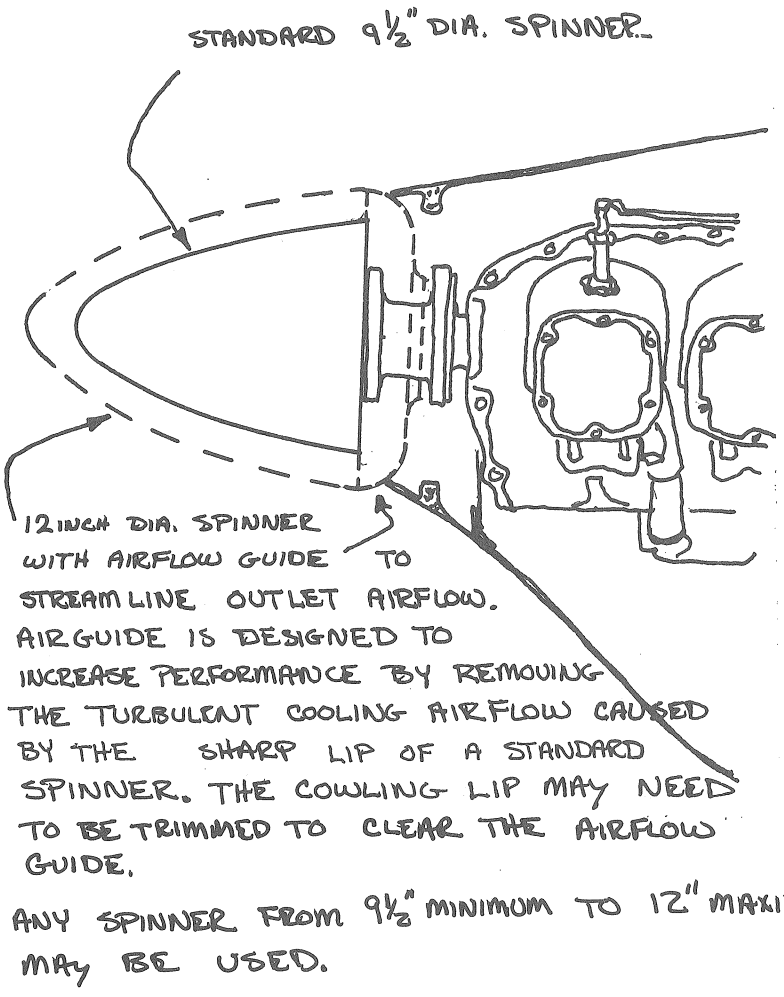
Install your prop, extension, and spinner. Follow the instructions supplied by the manufacturer.

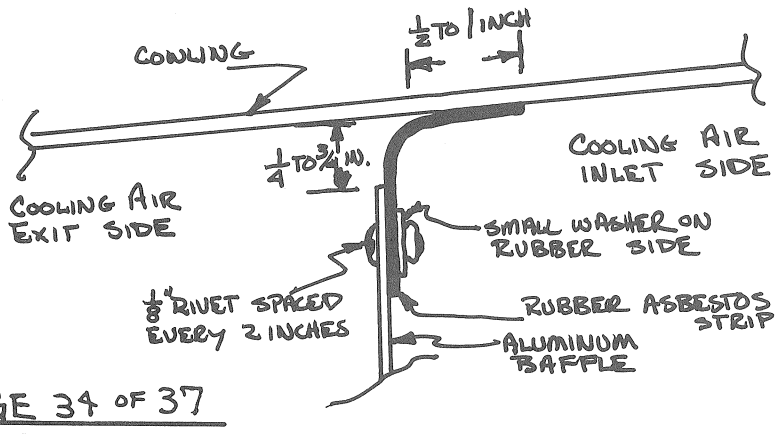
Proper torquing of your prop bolts is very important. One method to use is as follows: tighten all of the prop bolts until the bolt heads just begin to apply pressure on the rear plate(everything up snug). The rear plate must be a minimum 5/16 thick 2024-T3 aluminum. Mark a zero reference position on each bolt head and on the rear plate next to it. Make a second mark 270° (3/4 turn) clockwise from the firstmark. Progressively tighten the bolts to the second mark giving each 3/4 of a turn in the process. This proceedure is simple and will give the correct torque, however determining the snug position can be difficult if you have tight bolt holes in your prop or a tight centering hole. If you are in doubt about using this technique, use a torque wrench and tighten the bolts to 180 inch-pounds.

It is wise to check propeller bolt torque periodically, especially during periods of changing humidity, to ensure that it has not decreased. Before each flight inspect the prop for signs of discoloration due to friction (char). Keep it tight and a wooden propeller is a safe reliable part of your airplane.

The propeller should be positioned vertically for removal of the top cowl. Position the prop horizontally for bottom cowl removal.

Install your cowling one half at a time and measure the distances from the aluminum baffles to the cowl for fit-up of therubber asbestos seal strips that you see in all of the photos. Install this stripping on the forward and aft baffles as you see in the photos and accompanying sketches (step 13). After you have the principal seal strips in position look for any areas which might allow cooling air to escape without doing its share of engine cooling. Close off any leaks with additional rubber asbestos gap seal strips as required.





BEXDIX-STROMBURG CARBURATORS

As we are getting ready to go to press, we have discovered a potential problem area with the use of Stromburg carbs (NAS 3). We find that the minimum required fuel head for proper operation of the Stromburg NAS 3 carburator (19 in.) is much greater than that for the Marvel-Schebler MA-3 type (5-7 in.) that we have been flying. Many of the older engines, A-series, and C-series engines, are equipped with the Stromburg carburator, and it is probable that the fuel system will not be adequate for it. All of our development testing has been done with the Marvel-Schebler.

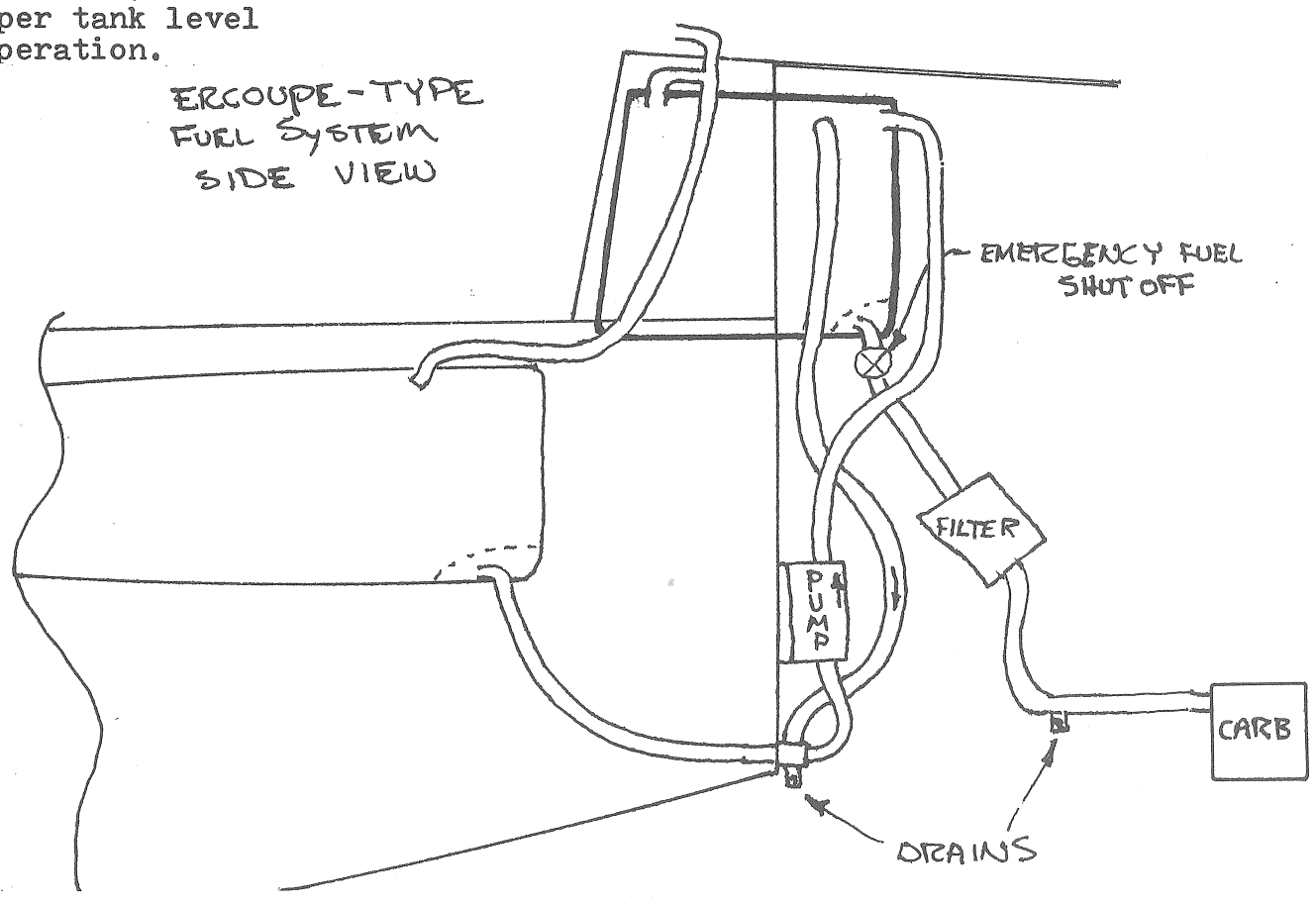
The sketches shown below depict a modified fuel system which will provide a substantially increased fuel head and should provide sufficient head for the use of the Stromburg carburator. We have not prototyped this system and it's details of fabrication and installation are undefined. The system shown is the same basic arrangement as used in the Ercoupe and VariViggen S.P.. The system requires a pump to continually replenish the upper tank. The upper tank stays full until the main tanks are empty or in the event of a pump failure, which would still leave a 45 minute (4.3 gal) supply in the tank. R.A.F. plans to eventually prototype this system and test it in service. Results, when available, will be published in the Canard Pusher newsletter.

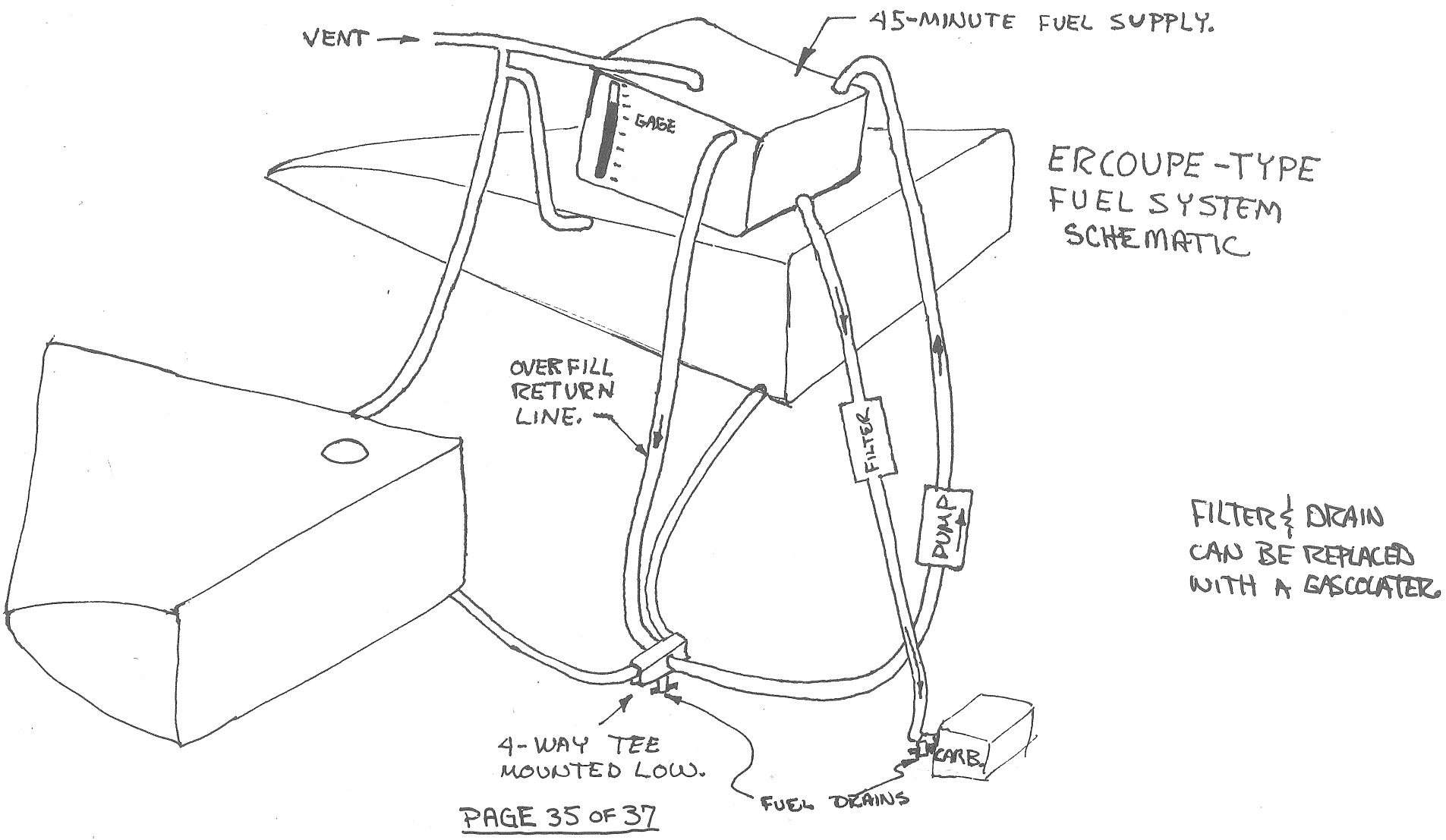
The system shown has a good fuel head even parked nose down and in a low fuel level descent. The greatest drawback to this system is that it requires a fuel pump (engine driven, electrical, or manual) to operate continuously. A pump malfunction would require a landing within 45 minutes. The pilot would have to monitor the upper tank level (full) frequently to verify pump operation.

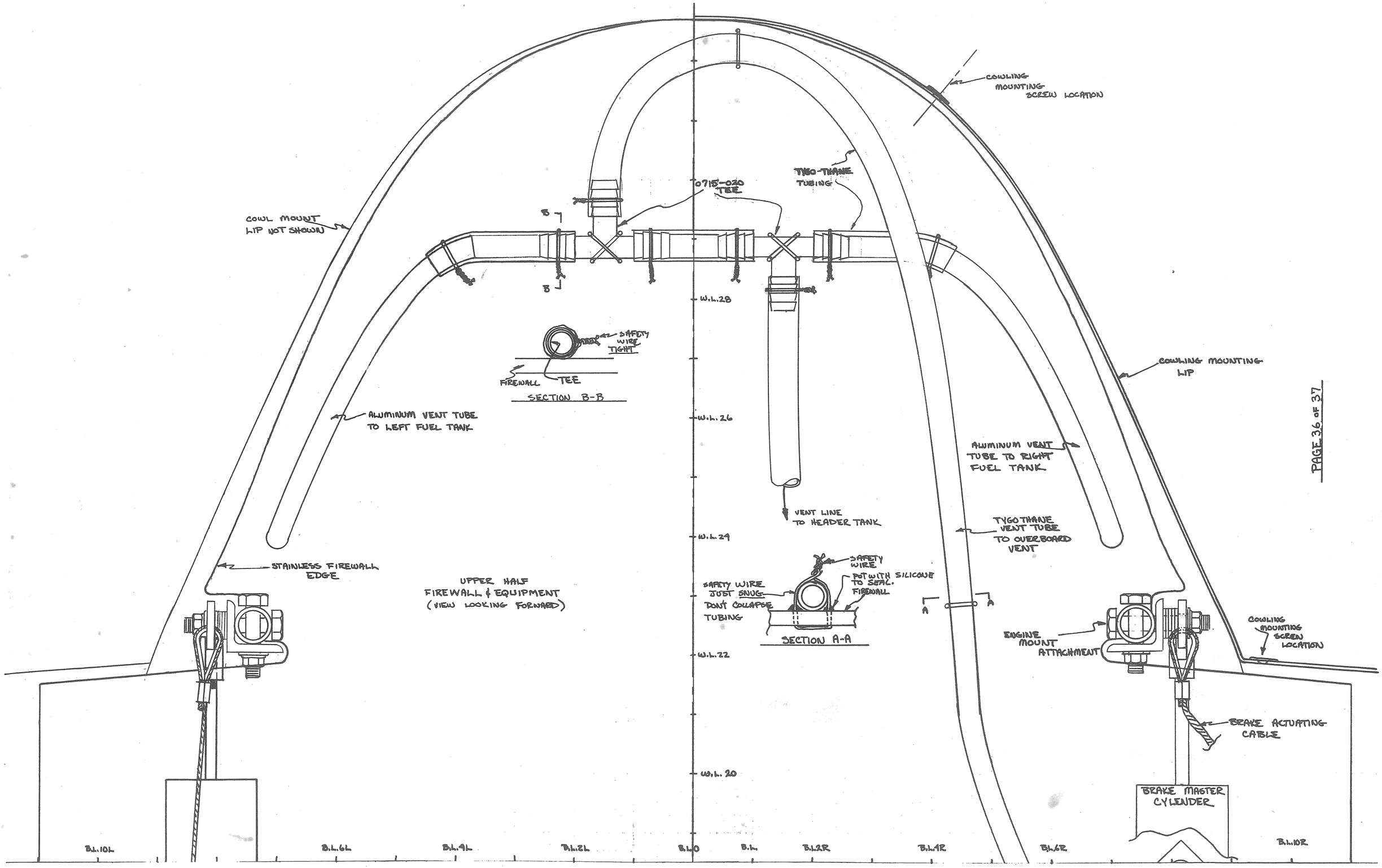
The upper tank would add 4.3 gallons to the total fuel capacity of the airplane and give a more reliable indication of the last few gallons. This system would eliminate the engine-mounted header tank and leave the vacuum pump mounting pad available for a vacuum pump installation if desired. The upper tank needs a 1000 cubic inch volume to allow for 45 minutes fuel supply, which means that the tank must protrude through the firewall and should have a stainless steel (fire proof) protective cover. The tank itself could be aluminum or glass/foam/glass construction. Electrical gauging or low fuel warning could be installed in the upper tank to inform the pilot of low fuel level or failed pump.

This system should work well for either the Bendix-Stromburg or Marvel-Schebler carburetors.

NOTE: A line from the tee to the carburetor with a shutoff valve could be added. The valve could be opened <u>if</u> the pump failed, allowing direct gravity feed to the carburetor for all flight conditions except steep descents.

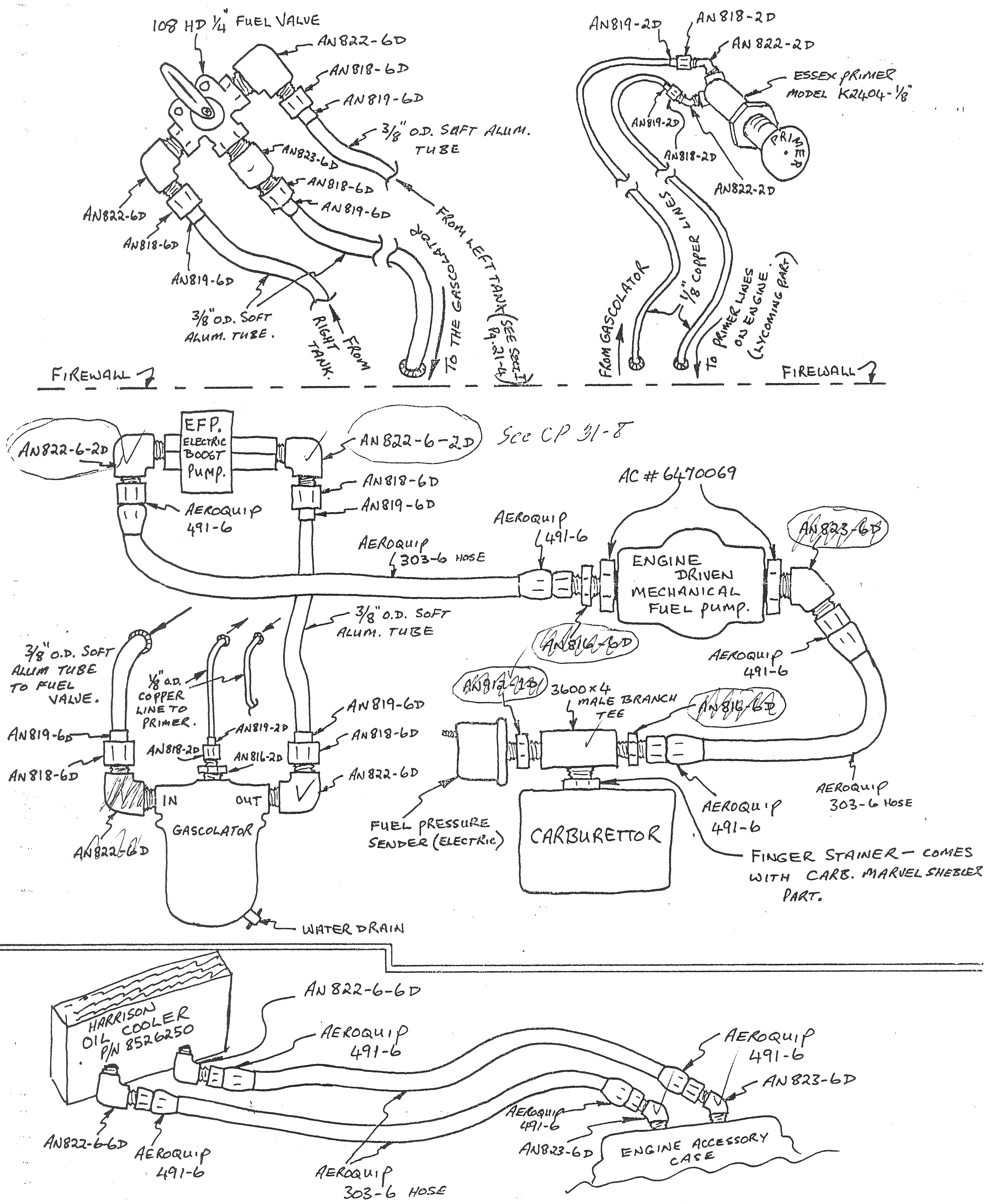




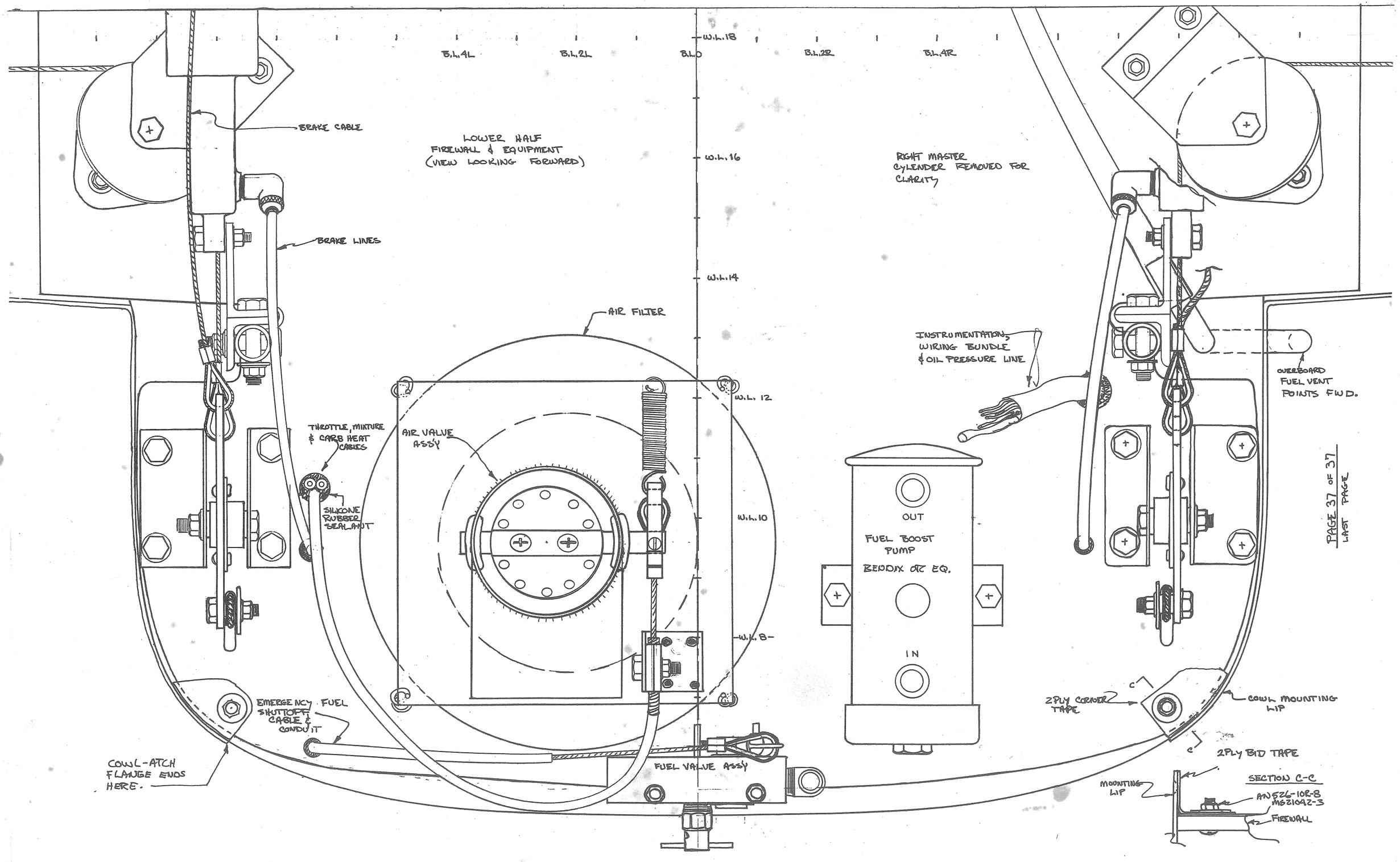

COWLING MOUNTING SCREW LOCATION
TYGO-THANE TUBING
0715-020 TEE
COWL MOUNT LIP NOT SHOWN
B
B
W.L.28
SAFETY WIRE TIGHT
FIREWALL
TEE
SECTION B-B
COWLING MOUNTING LIP
ALUMINUM VENT TUBE TO LEFT FUEL TANK
W.L.26
ALUMINUM VENT TUBE TO RIGHT FUEL TANK
VENT LINE TO HEADER TANK
W.L.24
TYGOTHANE VENT TUBE TO OVERBOARD VENT
STAINLESS FIREWALL EDGE
UPPER HALF FIREWALL & EQUIPMENT (VIEW LOOKING FORWARD)
SAFETY WIRE
SAFETY WIRE JUST SNUG DONT COLLAPSE TUBING
POT WITH SILICONE TO SEAL FIREWALL
SECTION A-A
A
A
ENGINE MOUNT ATTACHMENT
COWLING MOUNTING SCREW LOCATION
W.L.22
BRAKE ACTUATING CABLE
W.L.20
BRAKE MASTER CYLENDER
B.L.10L
B.L.6L
B.L.4L
B.L.2L
B.L.0
B.L.
B.L.2R
B.L.4R
B.L.6R
B.L.10R

PLUMBING SCHEMATIC A1 · PARTS CALL-OUT.

INFORMATION ON THIS PAGE SUPERCEDES ANY INFORMATION SUPPLIED IN LONG-EZ PLANS, SECTION I.



ALSO SHOWN ON Pg. 18


LOWER HALF
FIREWALL & EQUIPMENT
(VIEW LOOKING FORWARD)
B.L.4L
B.L.2L
B.L.0
B.L.2R
B.L.4R
W.L.18
W.L.16
W.L.14
W.L.12
W.L.10
W.L.8
BRAKE CABLE
BRAKE LINES
AIR FILTER
AIR VALVE ASSY
THROTTLE, MIXTURE & CARB HEAT CABLES
SILICONE RUBBER SEALANT
EMERGENCY FUEL SHUTOFF CABLE & CONDUIT
COWL-ATCH FLANGE ENDS HERE.
FUEL VALVE ASSY
OUT
FUEL BOOST PUMP
BENDIX ATC EQ.
IN
RIGHT MASTER CYLENDER REMOVED FOR CLARITY
INSTRUMENTATION, WIRING BUNDLE & OIL PRESSURE LINE
OVERBOARD FUEL VENT POINTS FWD.
2PLY CORNER TAPE
C
C
COWL MOUNTING LIP
2PLY BID TAPE
SECTION C-C
MOUNTING LIP
AN526-10R-8
MS21042-3
FIREWALL

BILL OF MATERIALS

PARTS AVAILABLE FROM AIRCRAFT SPRUCE OR WICKS AIRCRAFT.

6 AN 3-7A Bolts
2 AN3-14A Bolts
2 AN4-12A Bolts
4 AN4-13A Bolts
2 AN4-14A Bolts
18 MS21042-3 Nuts
8 MS21042-4 Nuts
10 AN509-10R8 Screws
2 AN111-4 Cable bushings
*3 AN818-2D Nuts
*3 AN819-2D Sleeves
6 AN818-6D Nuts
6 AN819-6D Sleeves
*2 AN822-2D Elbow
4 AN822-6D Elbow
2 AN822-6-2D Elbow
**2 AN822-6-6D Elbow
*1 AN816-2D Nipple
1 AN816-4D Nipple
2 AN816-6D Nipple
4 AN823-6D Elbow
1 AN910-1D Coupling
1 AN912-1D Bushing
1 3600 x 4 Weather-Head Male Branch Tee.
2AC #6470069 Adapters
2 Aeroquip 491-4 Fittings
4 Aeroquip 491-6 Fittings (** 8)
33" Aeroquip 303-6 Hose (** 84")
6" Aeroquip 303-4 Hose

4 Blow proof exhaust gaskets Lyc. #77611
8 Lock Washers MS 35333-41
8 Exhaust Manifold Nuts Std. 1410 5/16 - 18 Lyc.

18" 3/8" O.D. x .035 wall 4130N steel tube.
18" 3/4" I.D. x 1/8" wall Tygon plastic tube.
6" 3/4" O.D. x .049 wall 6061-T6 alum. tube.
8" 3/16" x 3/4" 2024T3 Alum. bar.

24 Nylon ty-raps (6"long) TY-525M
24 Nylon ty-raps (12" long) TY-528M
1 tube high temp RTV (silicone) (red or silver)

** Only required if an oil cooler is used.
* Only required if a primer is used.

Electrical

1 Micro switch type V3 or Radio Shack 275-1102

Engine Mount Hardware

For Conical Mount:

4 AN6-43A Bolts
4 AN960-616 Washers
4 Lyc. # Std 619 Washers
4 AN363-624 Nuts
8 #71032 Rubber Bushings. or 8 #60883 rubber bush

CP 28-9

OR

For Dynafocal Mount:

4 AN7-35 A Bolts
8 AN960-716 Washers
4 AN 363-720 Nuts
8 Dynafocal Bushings (for 2 3/4" I.D. Retainer)
4 Steel Spacers.

Baffle Material

5" of 1/8" x 1" x 1½" 2024 T3 Alum Angle
1 pc. .025 - 6061T6 Alum. Sheet 30"x48"
1 pc. 1/16" x 12"x 40" Neoprene - Asbestos
200 Avex 1601-0410 Pop rivets
200 AN960-4L Flat Washers.
12 AN500-A416-10 Baffle Screws
12 AN936-A416 Lock Washers.
2 AN931-6-16 Rubber Grommets

48" of 2½" dia. 'Scat' aeroduct
12" of 2" dia. 'Scat' (optional cabin heat)
12" of 1½" dia. 'Cat' (optional cabin heat)
4 Stainless worm clamps #136 (2½" dia.)

2 each #CS springs (½" long x .35" O.D. x .06 wire compression).
2 each Century #C-161 Springs.

Optional

* 1 Essex Primer #K2404-1/8"
** 1 Harrison Oil Cooler P/N 8526250

Brock - Supplied Components

Carb Heat - mixture - throttle quadrant assy.
Long-EZ Spinner - - - - - - - - VESPI
Prop Plate - - - - - - - - - - - KM01068
3-inch Prop Extension - - - - KM06018
Exhaust System with heat muff -BJX-IHM
Cabin Heat Valve (optional)
Carb. heat valve assy. - - - - VECHVA
Electric fuel pump - - - - - - EFP
Carb heat flange (optional) - VELY13
Long-EZ Lyc. O-235 Conical or Dynafocal engine mount.
2 Steel Bushings - - - - - - - LL-3 → See CP 32-7
2 Alum. Bushings - - - - - - - LL-4
2 spacers Part #SP-5 CP 32-7

Ram inlet scoop See CP 31-5

Q. I haven't been able to get to one of the demos--when can I see the VariEze?

A. We have not been showing it on an individual basis since this requires locking up, traveling a mile and opening the T-hangar. The response has been so great that this would take all our time. This situation will be resolved by about the end of February since we will be moving into a hangar on the flight line so you can come in anytime and inspect the airplane.

Q. I don't want to build an airplane that is still undergoing changes. When are you going to freeze the design and stop making changes?

A. We are more interested in the research and development aspects of aircraft than in marketing/promotion. Trying different things to improve an airplane is where our expertise lies. We expect to continue to use the VariEze as a research test bed for a long time, experimenting with several interesting concepts and may be making changes ten years from now.

Q. I'm just about ready to make the first flight in my VariEze. What words of wisdom do you have to the "about to be" test pilot?

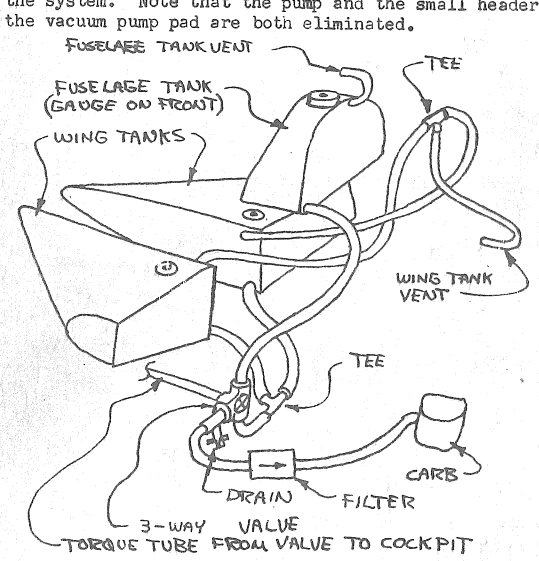
A. The best thing we can tell you is to read your owner's manual very carefully and follow exactly all the information and limitations shown. The VariEze is a very stable airplane but has lower stick forces than the average lightplane. So, get some time in a Yankee or other "sensitive" airplane. Also, remember that your rudders are a more powerful roll control than the elevons, and if your new airplane is crooked you may need rudder to keep things upright. In fact, you should fly the airplane primarily with rudder, since if there is anything that takes getting used to on the VariEze it is the tendency to input pitch when trying to use only aileron. So, if you use the stick only for pitch and the rudder to turn, things will seem easier, particularly if your proficiency is not good. Also, remember to keep the airplane in trim by adjusting pitch, roll and yaw trim. When in trim the airplane will hold speed and level flight even in turbulence without pilot effort. This will make your initial flights much more comfortable than fighting an out-of-trim condition. On final approach, set up roll and yaw trim for coordinated level flight, then the rest of the landing is VariEze indeed.

Too many people do a professional job of building their airplane then lose everything because they do a non-professional job of flight testing. If something is not quite right--fix it before you fly. Be sure your pilot proficiency is sharp and current.

Add these words to Owner's Manual

IMPROVED VARIEZE FUEL SYSTEM

We have recently tested a new fuel system in N4EZ that offers some significant advantages over that currently shown in Section IIA of the plans. The following schematic shows the system. Note that the pump and the small header tank on the vacuum pump pad are both eliminated.



SEE PHOTOS ON PG 8.

The fuselage tank is filled when the aircraft is fueled--it has its own cap (same cap as on wings). The fuel system is operated as follows: The fuselage tank is normally used only for starting the engine with the nose down. The wings are selected after the nose is up and the pilot gets in. If the flight is planned so that the descent is done with less than two gallons in each wing, the pilot selects the fuselage tank for the descent and landing. Regardless of the flight planning, the pilot can use all the wing fuel in level flight or climb (There is less than 0.1 gallon unusuable). He can use all but one gallon per wing in a normal descent and all but two gallons per wing in a steep descent. All fuselage fuel can be used in any attitude.

Addition of the selectable fuselage tank gives the pilot a much more accurate indication of his last few gallons fuel, thus increasing range and decreasing his concern of exact usable fuel state when fuel is low. It also gives redundant backup for things like fuel vent blockage, loss of fuel cap, etc. It does require fuel management though, but not more so than with the pump. The fuel selector is designed to mildly interfere with the pilot's wrist to remind him not to take off with the fuselage selected, thus depleting descent fuel first.

The selector handle is positioned left for wings, up for fuselage, and right for off. The selector valve is operated directly with a torque tube running forward. The torque tube is easy to install even with the side consoles in place. The torque tube has a mild curve which positions it against the fuselage side from F.S. 70 to F.S. 90, thus it does not interfere with the suitcase. Rout holes in bulkheads as required.

The system low point is provided with a drain adjacent to the selector valve. The drain is installed by drilling a five-sixteenth inch hole in the AN910-2D coupling and tapping with a 1/8-27 N.P.T. tapered pipe tap.

The fuselage tank is located forward of the firewall over the wing spar. The fuselage tank in N4EZ (see photo) is fiberglass. The front and back sides are three-eighth inch urethane (or PVC) foam with one ply BID on the inside. The top, bottom, and sides are two plies BID, laid up flat like the practice piece on page 3-13 of Section I. The pieces are assembled with epoxy, then the corners are rounded and two plies BID are layed over all the outside (overly wet layup to avoid leaks). The sight gauge, vent, cap, strainer, and fuel outlet are made similar to the wing tanks.

The tank was bonded to the spar on the bottom with wet micro and a block of six-pound PVC foam and bonded to the roof at the top (around fuel cap) with a ring of PVC and wet micro. While this looks like it will work okay, it's probably a better idea to fabricate some metal straps and bolt the tank to the firewall. If your tank interferes with the canopy brace bar, move the bar forward. A welded aluminum tank could be substituted if desired, or better yet, maybe we can talk Ken Brock into making a rotary-molded one like the original header tank.

One builder has told us that the Bendix-Strongberg carburetor will function satisfactorily with a very low fuel head and should work well with this new fuel system. We have not tested the Bendix carburetor so we have to leave verification of this up to you.

Some of you may not like the idea of a fuel tank within the confines of the cockpit. This is, however, a fairly common practice for many lightplanes. We feel that the advantages of more reliable fuel flow near zero fuel level, outweighs any disadvantages and thus recommend that you install this new system in your VariEze. DETAIL DRAWINGS ON PAGE 6.

Make the following changes to your Owner's Manual, Section IV.

Check List

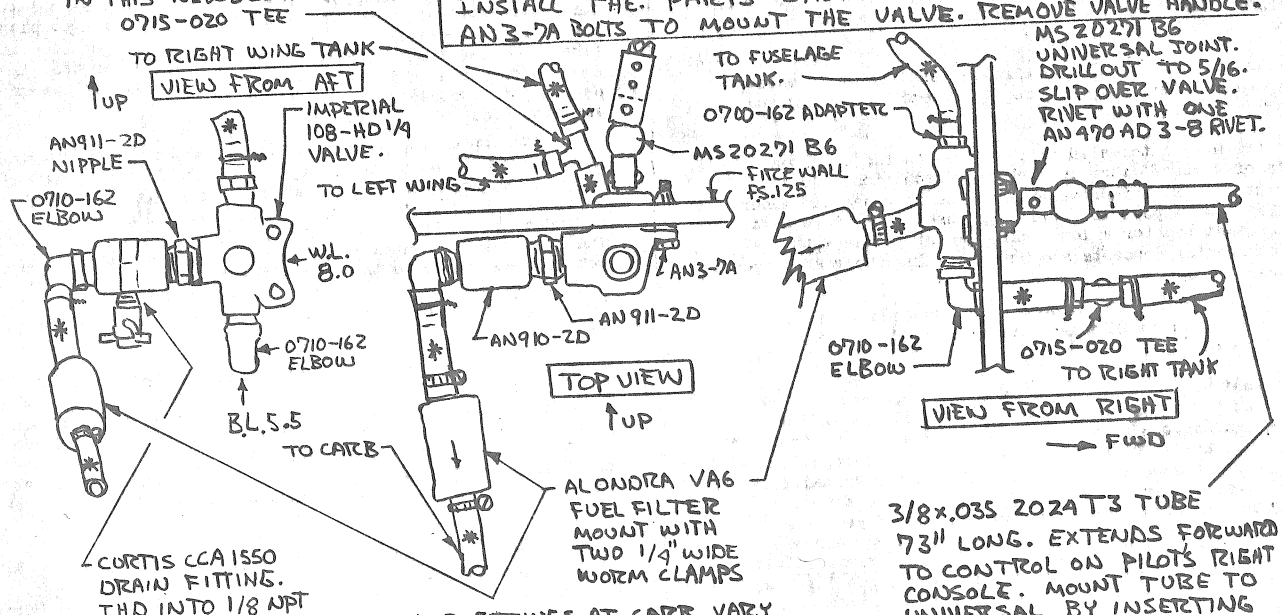
Engine start--add "select fuselage tank" before "mixture rich." Before takeoff--add "wings" after "valve on." Descent--omit "if low fuel refill header tank each six minutes." Add "select fuselage tank if wings are less than two gallons each."

OWNER'S MANUAL CHANGES CONTINUE ON PAGE 7.

SAFETY ALL HOZE AS SHOWN IN SECTION IIA.
THE VALVE MOUNTS ON THE FIREWALL AT B.L.=5.5, W.L.=8, JUST TO THE RIGHT OF WHERE THE FUEL PUMP WAS ON THE PREVIOUS SYSTEM. DRILL A 1.05" DIA HOLE (FLY CUTTER) THERE AND A 0.50" DIA HOLE 1.8" BELOW IT. INSTALL THE PARTS SHOWN USING TWO AN3-7A BOLTS TO MOUNT THE VALVE. REMOVE VALVE HANDLE.

VALVE & DRAIN

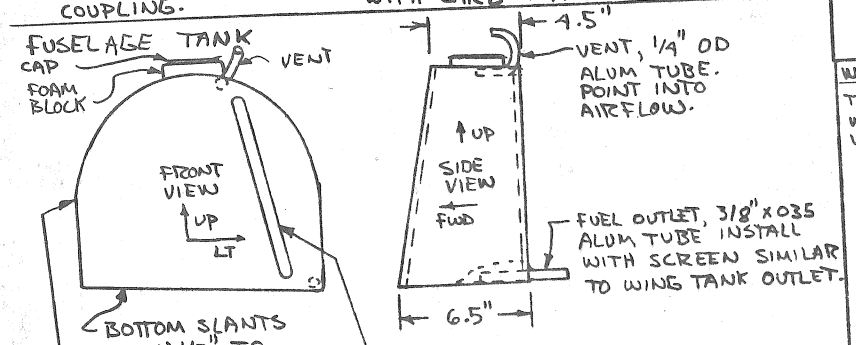
* ALL HOZE IS TYGOTHANE 1/2 x 3/8. SEE SECTION II. ALSO SEE PHOTO ELSEWHERE IN THIS NEWSLETTER.



CURTIS CCA1550 DRAIN FITTING. THD INTO 1/8 NPT HOLE IN AN910-2D COUPLING.

NOTE: FITTINGS AT CARB VARY WITH CARB TYPE.

3/8x.035 2024T3 TUBE 73" LONG. EXTENDS FORWARD TO CONTROL ON PILOT'S RIGHT CONSOLE. MOUNT TUBE TO UNIVERSAL BY INSERTING BOTH INTO A 2-INCH LENGTH OF 0.5 x .058 2024T3 TUBE AND RIVET WITH 3 AN470AD3-10 RIVETS.

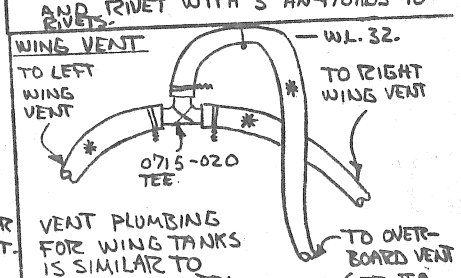


BOTTOM SLANTS DOWN 1/2" TO FUEL OUTLET SIDE.

THIS CONTOUR IS SHAPED TO FIT YOUR AIRPLANE ON SIDES AND TOP. LEAVE ROOM AT THE SIDES FOR WING TANK VENT LINES.

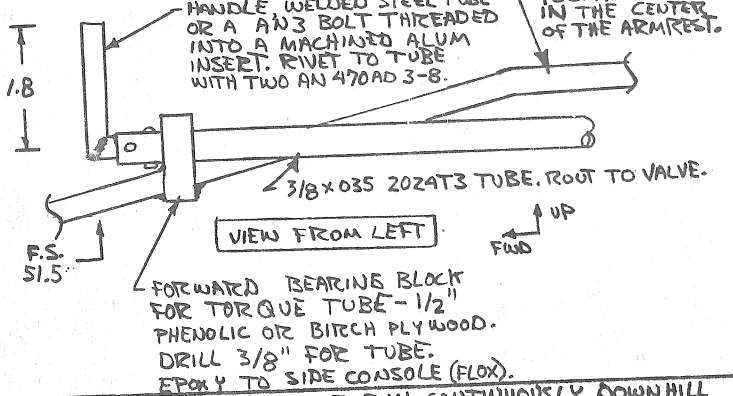
SIGHT GAUGE SIMILAR TO WING TANKS (SEE PHOTO).

WING VENT



VENT PLUMBING FOR WING TANKS IS SIMILAR TO PREVIOUS SYSTEM EXCEPT HEADER TANK VENT IS OMMITTED.

PILOT'S FUEL VALVE CONTROL



FUEL SYSTEM REVISED HARDWARE LIST. (AVAILABLE FROM BROCK, AIRCRAFT SPRUCE, OR WICKS).

15 FT	TYGOTHANE 0505-107 1/2 OD x 3/8 ID
2 ea	0715-020 TEE (RYAN HERCO)
2 ea	0710-162 ELBOW (RYAN HERCO)
1 ea	0700-162 ADAPTER (RYAN HERCO)
1 ea	IMPERIAL 108-HD 1/4 VALVE
2 ea	AN3-7A, MS21042-3, AN960-10
1 ea	AN 911-2D NIPPLE
1 ea	AN 910-2D COUPLING
1 ea	CURTIS CCA 1550 DRAIN VALVE
1 ea	ALONDRA VA6 FUEL FILTER
2 ea	1/4" WIDE 1/2" DIA WORM CLAMP
1 ea	MS 20271 B6 UNIVERSAL JOINT
5 ea	AN 470AD3-8 RIVETS
3 ea	AN 470AD3-10 RIVETS
1 ea	FT-18 CAP ASSY (BROCK)

THIS LIST REPLACES THE ONE ON PAGE 2 OF SECTION IIA.

DO NOT SUBSTITUTE VINYL, POLYETHYLENE, POLYPROPYLENE, ETC FOR TYGOTHANE.

WING TANK FUEL LINES MUST RUN CONTINUOUSLY DOWNHILL TO THE VALVE. ALL VENT LINES MUST RUN CONTINUOUSLY UP HILL TO allow DRAINAGE IF FUEL-FILLED.